



**Passing it on -  
Technology Transfer for  
Assistive and  
Accessible  
Information and  
Communications  
Systems**

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## Introduction

The problems associated with transferring assistive devices from the laboratory to being widely available are significantly different from those associated with introducing mainstream products and services which are usable by people with disabilities. This booklet is an introduction to both these areas where much work needs to be done to resolve the barriers to progress.

In the area of assistive technology for people with disabilities, many devices have been developed, some of which were successful, but most have failed to make the transition from the laboratory to being generally available at affordable prices.

Successful examples of technology transfers include:

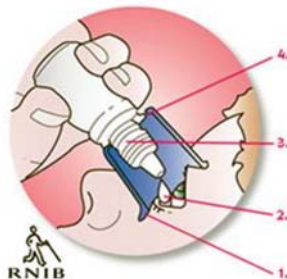
- *Tiresias*, a typeface designed to improve the legibility of subtitles on television screens for partially sighted people. A secret of its success was that it was marketed for only a nominal fee in the UK, where it was well received. It was subsequently marketed in other countries at a commercial price, and became a best seller.



- An eye drop locator, developed to help people with low vision administer their own eye drops, but also found useful by other people. The company sold 90,000 units in the first two months.



- Limited vocabulary speech recognition was developed to help those with poor manual dexterity, but is now common on mobile phone handsets.



*It is vitally important that equipment and services developed for mainstream users should be accessible to the widest possible range of people with disabilities*

- Predictive text was developed for disabled people who had to communicate one letter at a time, but it rapidly found a wider application for texting on mobile phones.

In some cases the devices have not met an unmet need, but there are many others where the technological aspects of the device were excellent and it was potentially useful. The difference between devices for disabled people and general technical developments is that the market is not simple – the inability of the potential user to afford the full price of the product coupled with the peculiar subsidies which vary from one sector to the next mean that this area requires extensive experience to negotiate the various pitfalls.

*Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services. It is closely related to (and may arguably be considered a subset of) knowledge transfer.*

*From Wikipedia*

## Technology transfer

Technology transfer may involve converting the design to one suitable for manufacture in an economic manner as well as marketing and providing support for the product. In the case of users with disabilities the provision of training in the use of the device may be time consuming and therefore expensive. The person who undertook the original

development of the device may not have the necessary skills to manage these activities, but at the same time may be reluctant to hand over to another party who is perceived as not having an understanding of the needs of the disabled consumer and may not have the enthusiasm to devote to this activity. This enthusiasm is often mentioned as a key factor in bringing a device for disabled people to the market.

Since software is easy to replicate it is often considered relatively simple to bring to the market. However many disabled users may require extensive support to configure and efficiently use the software. Together with the high costs of marketing to this sector, it can mean that the price of the software is greatly in excess of the equivalent in the mainstream area, and this results in a reduction in sales.

Assistive technology devices are often required in relatively small quantities, but modern production techniques require large quantities to keep the unit price low. However some companies are set up to produce small quantities for military use, but have times when they have no work so are interested in manufacturing assistive devices to keep their workforce occupied. These companies frequently have no relevant expertise in marketing, so that has to be done by another organisation.

Funding bodies have long been concerned that they fund research but the products fail to reach the market.

One technique which has been used to good effect has been not to fund the research directly but to agree to pay a considerable price for the first few units which reach the market with the appropriate support facilities in place.

The regulations regarding subsidy to assistive devices varies from one country to the next, and it can also vary by application (eg in education or employment). This situation does not appear likely to be resolved in the foreseeable future, so those marketing assistive devices need clear guidance as to the various systems of subsidy which are currently in use in various areas and countries.

Not all devices are for individual use. For instance audio beacons to help blind people navigate public spaces have been piloted in many countries. Often the manufacturers insist on using proprietary protocols whereas the purchasers want systems based on open standards so that they are not trapped in a single supplier situation.

Designing accessible mainstream information and communication technology (ICT) systems requires developers to have a good understanding of the aspects which affect the ability of individuals to use specific systems and services. All too often



*As banks make their systems increasingly computerised, self service terminals such as bank cash machines need to be accessible and operable by people with physical, visual and hearing impairments.*

designers consider accessibility issues too late in the design process; like quality, accessibility needs to be considered from the outset and not added at the end of the process like a coat of paint.

Traditionally designers would test prototypes with a range of potential users to identify any problems. However nowadays the speed of converting a concept into a production model often means that there is no prototype to test, so all evaluation has to be done with computer simulations.

## The Key Factors

### Awareness

Many companies put short-term profitability ahead of the need to improve usability and accessibility of their products. Sometimes this is due to ignorance of the real needs of people with disabilities; this





situation has not been helped by the fund-raising image of some user organisations being associated with a particular group with very special needs. The usual image of a disabled person is someone in a wheelchair or someone who is totally blind or totally deaf. These people exist but more typical is an individual who has a combination of impairments.

It is a myth that all blind people:

- Read braille
- Love animals
- Are musical
- Have bionic hearing

Various methods for simulating disabilities have been developed; these have been useful despite their limitations but they are not the complete solution. Having direct contact with a range of people with disabilities is a better, even if time consuming, approach. It is important to consult a range of end users and not just a few articulate ones who may not represent the varied needs of the user population. Working with people with intellectual impairments may require members of the design team to learn new communication skills.

It is desirable to involve people with disabilities in every stage of the design process but this is not always practical when the various stages are undertaken in more than one location.

There is a need to educate organisations representing people with disabilities as to what can be technologically achieved and the related costs. This is a particular problem in the area of fast changing mainstream technology such as smart phones and cloud computing. Also these organisations seldom participate in discussions on priorities for future research since they lack people with the skills to understand the potential of new developments to help people with disabilities.

Many accessibility issues are related to lack of awareness by the product and service design team. Embedding inclusive design in the higher education curricula would improve this situation; as yet this approach has been used in a few courses but it needs to become the norm before significant improvements can be expected.

*Inclusive design is the design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible on a global basis, in a wide variety of situations and to the greatest extent possible without the need for special adaptation or specialised design.*

*Center for Universal Design at North Carolina State University*



*Computer based learning is an integral part of education - computer interfaces and controls must be made accessible to all.*

### **User Needs**

Many businesses claim to have thorough understanding of the needs of their customers, but this is rarely the case when the customers are people with disabilities. Often the effect of the disability is to cause a number of secondary problems which could be alleviated by the appropriate use of technology.

### **Lack of privacy is one of the greatest deprivations caused by blindness.**

Translating user needs into a design specification is a complex and difficult task. As a result designers tend to jump at a single aspect without looking at the overall needs.

### **Development Policies**

Commercial companies in the disability area tend to be risk adverse so prefer to update an existing product rather than market a truly innovative concept. New concepts may not get subsidised until such time that they have significant market penetration, but the market may not exist until a subsidy is available.

Therefore, many projects are based on incremental improvements of available technology and produce only marginal advantages for end users, which do not justify the implementation of new equipment and/or services. It is therefore necessary to encourage research projects that are based on real technological innovations and produce significant advantages for users.

In the past funding bodies have been reluctant to provide funding specifically for the transition from laboratory prototype to production model since this was not perceived to be within their remit. However

this reluctance has led to much research failing to benefit the end users.

One model which has been used successfully was: **Provide research funding which was only payable when the first products were on the market with the appropriate support services.**

### **Product Specification**

For publicly available systems and services consumers expect the user interface to work in a consistent manner. For example a card used for ticketing on public transport may also have the capability of being used to pay for low value purchases; the consumer expects the process of using the card for the two services to be similar (including the audio signals relied on by the blind users).



The ability to adapt the user interface to suit individual preferences would make terminals easier to use by a significant number of people. These preferences could be coded on the user's card or stored in the network.

**The European standard EN 1332-4 specifies how to code user preferences.**

One limitation is the reluctance of designers to provide standard interfaces to permit disabled users to connect an assistive device to a mainstream product. This reluctance seems to come from the lack of a business case for the increase in cost of providing such an interface if it is perceived to be solely for use by disabled people. However a number of companies are developing systems to permit customers to use a mobile phone handset to access a terminal; this is primarily perceived as increasing the potential number of customers but could also help some disabled users.

**Good design for disabled people is frequently good design for everyone.**

If more companies were to integrate an accessibility philosophy in their product design there would be a greater choice of more accessible and assistive products reaching the market. However this will



*Modern manufacturing techniques aimed at the mass market can be customised to meet the special needs of people with impairments.*

require considerable resources to educate designers about the needs of the disabled individuals. One approach could be an accessibility filter based on international guidelines and standards which would assist designers and product specialists to firstly understand accessibility and secondly guide them to develop more accessible products and services.

Traditional cost-benefit analyses often do not take into account indirect social benefits to the recipients which may be the essential aspect in deciding the level of state subsidy a product or service will receive. Too often the financial estimates of such benefits seem to be plucked out of thin air and not based on sound scientific data.

The disabled consumers often think that products and services tailored to their needs should not cost them more than the equivalent product or service for a non-disabled person. However assistive devices can be expensive to develop, manufacture and market. One possibility is for the state benefit system to provide extra funding to the disabled individual to compensate for the difference in price; this requires some accurate assessment of the individual's needs and equate that in financial terms. Another possibility is to subsidise the product or service but the problem is in deciding which products to subsidise; the market tends to become very distorted with a dichotomy between products which are 'approved' and those which are not. As technology evolves some products get superseded but changes in the subsidy system tend to lag.

### **Evaluation**

Many companies lack the specialist skills to evaluate designs with disabled users. There is a need to provide methodologies, tools and test environments which companies can access to test their prototypes. Also they may need advice on whether their design



meets any mandatory guidelines applicable in their target market. There may also be a requirement to have access to appropriate testing facilities at reasonable cost.

**All too often evaluation is seen by companies as obtaining a product endorsement from a user organisation. Whereas it should be seen as a method of obtaining information on how to improve the design of the product.**

### Technology Transfer Process

Although much has been written about the technology transfer process for mainstream products, the problems in the disability area are significantly different. Companies with experience in producing mainstream products often fail in the disability area since they have insufficient understanding of:

- The relevant legislation and regulation in various countries
- The financial subsidy systems in use in various sectors
- Insufficient understanding of the user needs
- Identification as to who is the purchaser and on what basis do they select products
- Mechanisms for making disabled people aware of the potential of new products or services
- The level of support this customer group will need to effectively use the product



*Everyday keypads initially designed to make life easier for blind people are easy to use by everybody*



*Many everyday products are useful to blind people, but it is unlikely that they would ever have been developed if the market was solely for blind people.*

### Broker Agencies

It has been proposed that there is an unmet need for independent advice to be available to companies in a form which is appropriate to their needs. The non-profit user organisations are not providing such a service, so a new mechanism should be established.

If a research team has an interesting prototype but is not interested in or does not have the capacity to take it further, then there needs to be a mechanism for the project to be passed on to an organisation which has the skills and motivation to bring it to market.

Many commercial organisations lack data about the potential market for assistive products. This data needs to be in a form which is immediately useful to people not specialists in disability matters. Also needed is sound data on the number of people who would benefit from making various mainstream products accessible.

### Thinking more widely about the uses of technologies

Another role could be to work with organisations in other areas to identify which of their technologies could be useful for people with disabilities. This is particularly relevant in the area of military developments but problems of commercial secrecy and sensitive information create an extra hurdle to be overcome.

When considering the development of products for use by blind people it is interesting to think about the telephone, the fountain pen, the typewriter, and the long-playing record. They have all proved useful to blind people for many years, but would they ever have ever become viable products if the market for them was just blind people?

A deep sea diver breathing helium has a high pitched voice – the technology for changing the pitch is the same as that needed by a blind person listening to a speeded up talking book.



*The Amron International speech unscrambler for divers uses real-time audio processing with both frequency and time domain technologies for optimized performance over a wide range of depths and background noise to provide intelligible speech from the diver's voice. Similar pitch-changing technologies can allow a blind person to hear a talking book being played back at faster than normal speeds.*

### Market Support

It is often important to look for applications outside the disability area which can make a significant difference to the economic viability of the product or service. Potential application areas need to be studied systematically and not by serendipity.

Funding for research and development projects for assistive technology should include the stage of technology transfer. Many funding bodies restrict funding to pre-competitive research without recognising that the area of assistive technology requires a different approach. It has been suggested that companies should receive tax breaks for providing accessible products and services; this could be an administrative nightmare to implement in a manner such that companies do not find loopholes to claim the benefit while not investing in accessibility.

When marketing a product based on new technology it is important not to blind the disabled customer with technical jargon but concentrate on what the new device can and cannot do to help a disabled individual. There have been a number of instances where public relations companies have over hyped a new product such that the disabled community reject it without even examining what help it could provide.

There are a number of different ways of measuring the prevalence and incidence of various impairments which marketing departments tend to find very confusing. The situation is not helped by the fund

raising departments of some non-profit agencies using exaggerated figures which have no scientific basis. What is needed is data based on the sales on other products in the same segment.

### Mandatory Requirements

Legislation and/or regulation can be used to require certain features in a product or service. However it has proved to be very difficult to write such specifications which achieve the desired objectives whilst not limiting the designer in the use of new technologies.

Open international standards have proved to be useful despite often being inconsistent or out of date (possibly because they are based on superseded technology). The existence of patents can stymie development by introducing delays which correspond to extra costs for the organisations developing the new product.

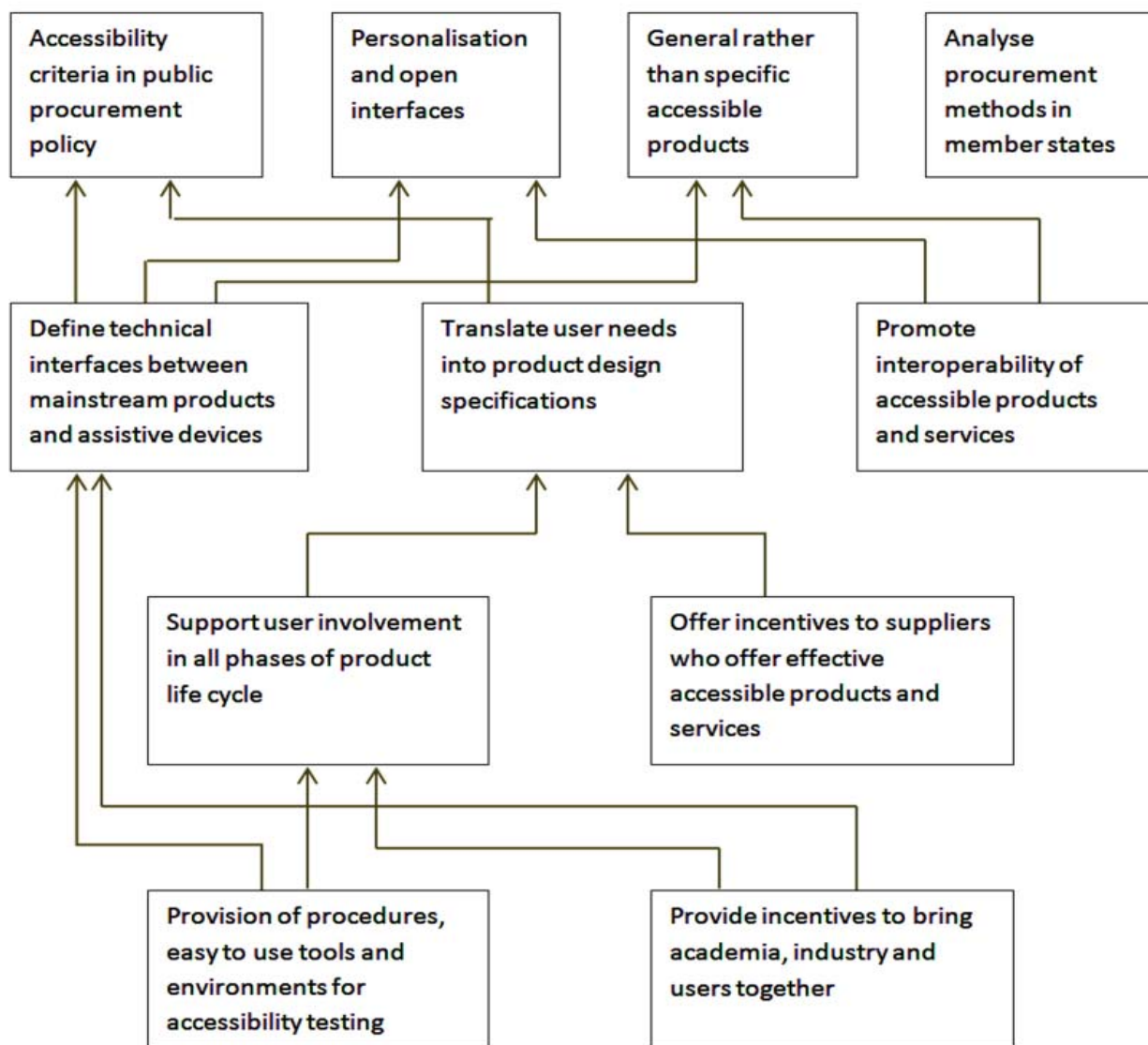
An alternative approach is legislation which requires public systems to be accessible, but does not define how this should be achieved or what is the precise meaning of 'accessible'. This approach has the advantage that it does not restrict the use of new technologies, but it creates income for the legal profession (whose costs end up being added to the price of the product).

A requirement for companies to publish their corporate social responsibility (CSR) policies in respect of accessibility could be beneficial. Currently many CSR policies reflect to what the company aspires. Making CSR policies in the public domain gives the possibility of outside organizations exerting pressure on companies to implement policies.

### Procurement Policies

There are two particular ways in which policies on public procurement can be expected to influence the availability of goods and services that are accessible to people with disabilities and older people. Firstly, there is the direct result when the required accessibility features are demanded by the purchasing authority within the terms of contract. Secondly, there is an indirect effect through which the purchasing practices of public bodies have an influence on wider product design in the relevant industries. The magnitude of this indirect effect will vary because of differences in national purchasing approaches.

Public bodies that need to buy goods and services, whether it is for general purposes or specifically to make provision for people with disabilities, will tender for their supply. The tender documents will usually be accompanied by a technical specification that describes the required product and forms the



*Simplified influence tree resulting from Cardiac Workshop*

The way this tree should be interpreted is that the actions which aim to support these four mechanisms will have the greatest influence in achieving large scale organisational change. Progress made in these four mechanisms will create a positive chain of facilitation because they are influencing directly or indirectly practically all mechanisms which lie above them.

basis for the ensuing contract. Any accessibility features that are needed will be detailed in the specification, using published standards where they exist. In the European Union, there is a clear obligation to use European Standards where these are available, and there is also a clear requirement to consider accessibility in all public forms of tendering. When tendering for ICT equipment it is common practice to buy a service package rather than just the hardware, so that maintenance and updating is included in the same contract. Nevertheless, the accessibility requirements can still be set out in the contract, although this may mean that they are provided to specific need rather than being incorporated in all of the equipment delivered. This customised approach may be particularly valuable in respect of telephone extensions on private branch exchanges.

Some purchasing bodies, particularly the FCC in the USA, have a policy of purchasing only standard commercially available items, but at bulk prices. This has the effect upon the market of encouraging all manufacturers to incorporate all the required accessibility features in their products, for otherwise they would not be eligible for that purchaser's contracts. In other instances suppliers are free to design and manufacture to the contract specification, or to modify a production design by adding or removing features so as to meet the specification at a competitive price. In these cases the public purchasing will have less influence on the general availability of accessibility features and it is not unknown for a product that incorporates certain features for one market-place to have them removed in another. The rationale for this is presumably to make savings in cost, weight or power consumption.



These comments upon public procurement may be applicable beyond the public sector. Large private sector organisations which operate a central procurement facility can achieve similar results in creating awareness and influencing behaviour among suppliers. If these organisations find that they need accessibility features to enable recruitment and retention of employees with disabilities, especially where that is a feature of national equality legislation, their purchasing practices will be a powerful influence upon the design of equipment and services.

## The way forward

The current situation regarding technology transfer is unsatisfactory in that relatively few research and development projects result in products or services of practical benefit to people with disabilities.

In the short term, there is an unmet need to provide independent guidance to companies developing new products. This could take the form of a series of guidebooks and/or the provision of broker agencies specialising in technology transfer issues.

In the medium term, the implementation of European accessibility requirements for government procurement in member states would be a significant step forward. This is likely to require the development of some new standards which will take time to write since it is essential that they are based on sound scientific data.

For the longer term, Cardiac is developing a roadmap for this area and held a meeting which discussed in detail the various factors. The collective wisdom of the participants revealed that the following four obstacles were probably the most influential:

- [Provision of procedures, easy to use tools and environments for accessibility testing](#)
- [Provide incentives to bring academia, industry and users together](#)
- [Support user involvement in all phases of product life cycle](#)
- [Offer incentives to suppliers who offer effective accessible products and services](#)

## Further information

*Proceedings of The AAATE Workshop on Assistive Technology – Technology Transfer.* <http://kt-equal.org.uk/uploads/aaateoct/aaatepreceedings.pdf>

Proceedings of The AAATE Workshop on Assistive Technology – Technology Transfer. <http://kt-equal.org.uk/uploads/aaateoct/aaatepreceedings.pdf>

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## About Cardiac

The basic concept behind the project is to create a platform that can bring together the various stakeholders in the area of accessible and assistive ICT with a view of identifying R&D gaps and emerging trends and generating a research agenda roadmap. It aims to identify examples of best practice and to disseminate the collective wisdom of all the relevant actors (both partners from within the project and stakeholders from outside the project) through, meetings, conferences and publications.

It aims to do this by looking into the wide range issues that play a role in the availability of accessible and ICT from issues related to research and future research priorities, development and design issues, right through to issues relating to making the business case and the adoption or non-adoption of a particular technology or service. It will also investigate both the barriers that hamper the availability of accessible and assistive ICT and the actions that can be taken to enhance availability. One technique that will be used is structured dialogue.

One of the main tasks of the project is to generate research agenda roadmaps that will identify the research topics that will require support in the short, medium and long term, both in terms of raising awareness and additional funding for research activities.

The specific areas that will be investigated range from:

- Inclusive human-machine interactions (short/medium and long term)
- network-based applications (medium and long term)
- systems and services supporting accessibility
- the transfer process itself (short and medium term), which includes the transfer of technology and the making of the business case (short and medium term).

Another area where a new approach is emerging is that of creating an inclusive infrastructure that can support commercial assistive technologies and public access features so that people can call up interface features or adaptations they need anytime, anywhere and on any device. This is a short to medium term issue and in the medium to longer term research effort will have to be directed towards developing the services and applications that can run on such an infrastructure. This will include research on ontologies (short and medium term) so as to ensure that all the various systems can interoperate.

The aims of the project will include:

- Identification of the state of the art in various areas – where are we now?
- Identification of gaps in current research in the area of accessible and assistive ICT
- Identification of the barriers to such research work
- Suggestions as to how to overcome such barriers
- Production of a ‘Research Agenda Road-Map’ to help the European Commission to focus on future ways to direct research funding
- Strengthening the global position of European industry in assistive technologies
- Gathering “factsheets” of what is being done in other major countries outside Europe as a benchmark and point of comparison.

[www.cardiac-eu.org](http://www.cardiac-eu.org)

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