Prolegomena to A Theory of Disability, Inability and Handicap

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1 Introduction

Underlying the political activism that led to the Americans with Disabilities Act (ADA) was what Ron Amundson has called the *environmental conception of disability*[1]. In [7] we called this the *circumstantial conception of disability and handicap*, and contrasted it with the *intrinsic conception*. We use *disability* to mean loss of a function, such as moving the hands or seeing, that is part of the standard repertoire for humans. *Handicap* is a species of inability, in particular, the inability to do something that one wants to do and most others around one can do.[1] The intrinsic conception imagines a tight connection between disability and handicap; the circumstantial conception loosens and relativizes that connection. The circumstantial conception reminds us that we all depend on various tools and structures—in particular, on cultural artifacts—to enable us to do what we want to do. In many cases it is the design of these tools and structures that prevents a disabled person from accomplishing what they want, rather than anything intrinsically connected to the disability. For example, very few people can get from the first floor to the second floor of a building without

[1] An *impairment* is a physiological disorder or injury; impairments may be the ground or cause of a disability.

the assistance of some structure such as stairs, ramps, or elevators. If no such structures are available, everyone is handicapped; if stairs are available, but not a ramp or an elevator, people with various disabilities are handicapped; if ramps or elevators are available, very few people are. Disabled people, like everyone else, are handicapped in the absence of the structures and tools that enable them to perform the tasks they need and want to do.

The ADA, in requiring that employers and others *reasonably accommodate* disabled workers, reflects this circumstantial conception of disability and handicap. The underlying idea is simply that many of the tasks that are necessary for getting to a job site and then accomplishing what the job requires can be done by individuals with disabilities, given the proper equipment and facilities. The way the disabled worker accomplishes these tasks may differ from the way other workers do. She may, for instance, use a wheelchair rather than walk to get to the job site; she may use a voice-recognition tool rather than typing on a keyboard to input to a computer.

Accommodation can be brought about in two ways. Where situations have been designed without consideration for individuals with disabilities, retrofitting is required; e.g. installing ramps or elevators, widening hallways, etc. Far better is the second way: to design with an eye more toward enabling the accomplishments required to satisfy the demands of the task rather than toward enabling a small range of (even widely employed) ways of satisfying those requirements. Providing stairs enables people who can walk to locomote between flights by (something akin to) walking—though it's still difficult for people who walk with crutches, say. Providing ramps enables both walkers and a wide range of non-walkers to locomote between flights—the former by walking, the latter, in other ways—and it makes it easier for walkers with crutches.

In developing and applying the circumstantial conception of disability, the following basic concepts are clearly central:

- Doing the same thing in different ways.
- Ability, inability, disability.
- Accommodating and enabling by (re)engineering the environment.

In this paper we extend a theory of action, IPT, presented in [5, 6], to try to elucidate these concepts. This attempt at elucidation is itself at most a prolegomena to a study that can usefully feedback into the moral and legal issues involving disabilities. In the concluding section, however, we try to use the concepts we have developed to enunciate a design principle, which we call *generic interfacing*.

In the next section we review our theory of action; in §3 we extend the theory to capture more adequately the structure of abilities and inabilities. In §4, we closely examine several cases to motivate and illustrate the notion of *generic interfacing*; in §5, we draw some conclusions.

2 Review of IPT

2.1 The Meaning of Movements

The strategy of IPT is to develop a theory of action that is modeled in important ways after the relational theory of meaning developed in [3].

- In [3], utterances were viewed as particulars that involve speaking or writing sentences of various types, in virtue of which various things get said, depending on the circumstances of utterance (the context).

  According to IPT, acts or movements are particulars that involve the execution of movements of various types, in virtue of which various results occur, depending on the circumstances of the act.

- In [3] the content of an utterance of a sentence is a collection of described situations; roughly, a proposition.

  In IPT, the results of movements of particular types in particular circumstances are modeled by propositions.

- We distinguish between direct and indirect discourse descriptions of utterances. Direct discourse identifies (more or less) the type of the expression uttered, while indirect discourse characterizes an utterance by way of its contents.

  In IPT we distinguish two ways of characterizing acts, as executions of movements of particular types, and as accomplishments, that bring about various states of affairs. Describing acts in terms of the movements executed is analogous to direct discourse description; describing them in terms of the results accomplished is analogous to indirect discourse.

- In [3], Barwise and Perry associate relations between contexts and contents with types of expressions; they take these relations to be the *meanings* of the expression types.[2]

  In IPT, we associate relations between circumstances and results with types of movement; we take these relations to be the *meanings* of the movement types.

Consider, for example, the type of movement one makes when pushing an elevator button. In different circumstances, a movement of this type will bring about different results. Standing in front of an elevator, it will call the elevator to one's floor; standing in front of an angry brute, it will cause one to get beat up, and perhaps to lose the offending digit. Think of the circumstances as the

[2]Barwise and Perry used the term "interpretation," but "content" has become generally accepted.

context and replace the described situation with the resulting situation, and the familiar pattern will emerge. Then think of both the circumstances and the resulting situation as characterized by propositions, and you have the basic concept of IPT, the meaning of a type of movement. In [3], the context of an utterance was analyzed into two components, the discourse situation and connective situation. In §3.2, we will see an analogue of this decomposition.

Where $\mathcal{C}$ is a set of basic constraints, $[\![M]\!]_{\mathcal{C}}$ is a relation between circumstances $\mathbf{C}$ and a result $\mathbf{P}$. $[\![M]\!]_{\mathcal{C}}(\mathbf{C}, \mathbf{P})$ obtains just in case according to $\mathcal{C}$, when a movement of type M occurs in circumstances $\mathbf{C}$, $\mathbf{P}$ results.

More explicitly, we define: $[\![M]\!]_{\mathcal{C}}(\mathbf{C}, \mathbf{P})$ iff

- any movement m that is of type M, that is effected in circumstances of type $\mathbf{C}(x_1, \ldots, x_n, m)$, will have as a result that $\mathbf{P}(x_i, \ldots, x_l)$ $(1 \leq i \leq l \leq n)$,
- where the x_i are additional parameters for objects and relations involved in $\mathbf{C}$.

2.2 Two types of actions: Executions and Accomplishments

In IPT, movements are acts. Acts are particulars, actions are properties of agents at times. An act is identified by an agent, a location, a time and a type of movement. Agents have action-properties in virtue of being the agents of the acts. We recognize two kinds of actions. *Executions* are properties that agents have locally and non-circumstantially, in virtue of the type of movement that they produce. Where M is a movement type, $\mathcal{E}[M]$ is the property of producing a movement of type M. *Accomplishments* are properties that agents have in virtue of the results they bring about, and so in virtue of the circumstances in which their acts occur, as well as the type of movement involved. The execution/accomplishment distinction is analogous to the direct/indirect discourse distinction, in characterizing utterances. Where $\mathbf{P}$ is a proposition, we use $\mathcal{B}[\mathbf{P}]$ to denote the property of bringing it about that $\mathbf{P}$.

2.3 Two relations between actions: Ways of and Modes of

A key concept in IPT, and one of particular importance in thinking about disabilities, is that of one action being a *way of* performing another action. In IPT we factor this into two relations. MO (for *mode of*) is a relation between executions and accomplishments, and WO (for *way of*) is a relation between accomplishments. For good measure we add the relation WOF, the disjunction of WO and MO. So moving one's left ring finger is a mode of bringing it about that an "s" appears on one's computer screen, while bringing it about that an "s" appears on my screen may be a way of bringing it about that a message gets sent.

But of course getting those results doesn't just depend on which movement one executes. It also depends on the circumstances an agent is in. One has to have one's hands poised over a keyboard, the keyboard has to be connected to a computer, which has to be turned on, etc. Note that more must be said about the circumstances in the second case than in the first; the agent must be in a mail program of a certain sort, etc. So the *mode of* and *way of* relations are not just relations between actions, but relations relation between actions and circumstances.

Here are the definitions:

- Executing M is a mode of bringing it about that $\mathbf{P}$ in circumstances $\mathbf{C}$ relative to constraint $\mathcal{C}$ iff, given $\mathcal{C}$, any movement of type M in circumstances $\mathbf{C}$ will have the result that $\mathbf{P}$.

  $MO(\mathcal{E}[M], \mathcal{B}[\mathbf{P}], \mathcal{C}, \mathbf{C})$, iff $[\![M]\!]_{\mathcal{C}}(\mathbf{C}, \mathbf{P})$.

- Bringing it about that $\mathbf{P}$ is a way of bringing it about that $\mathbf{Q}$ in $\mathbf{C}$ relative to $\mathcal{C}$ if any M whose execution is a mode of bringing it about that $\mathbf{P}$ in $\mathbf{C}$ given $\mathcal{C}$, is also a mode of bringing it about that $\mathbf{Q}$ in $\mathbf{C}$ given $\mathcal{C}$.

  $WO(\mathcal{B}[\mathbf{P}], \mathcal{B}[\mathbf{Q}], \mathcal{C}, \mathbf{C})$ iff

  $(\forall M)$ if $MO(\mathcal{E}[M], \mathcal{B}[\mathbf{P}], \mathcal{C}, \mathbf{C})$ then $MO(\mathcal{E}[M], \mathcal{B}[\mathbf{Q}], \mathcal{C}, \mathbf{C})$.

2.4 Ability and Inability

The IPT analysis suggests a conception of ability. We shall focus here on a simple, though basic type of case. Let $\mathcal{R}$ be a sequence of actions, either executions or accomplishments.

- $\mathcal{R} = \langle A_1 \ldots A_n \rangle$

$\mathcal{R}$ is an *executable method* for agent α to bring it about that $\mathbf{P}$ in $\mathbf{C}_1$ if:

1. A_1 is an execution
2. $A_n = \mathcal{B}[\mathbf{P}]$
3. for each $1 < i \leq n, \exists \mathbf{C}_i \, \langle WOF, A_i, A_{i+1}, \mathbf{C}_i \bigwedge \{\mathbf{C}_j\}_{1<j<i} \rangle$
4. α can perform A_1 in $\mathbf{C}_1$.

An agent α can perform $\mathcal{E}[M]$ in $\mathbf{C}$ if α can form a volition to execute M and this volition reliably causes M in $\mathbf{C}$.[3]

In sum, α is *able to bring it about that* $\mathbf{P}$, in a circumstance $\mathbf{C}$, just in case there is an executable method for α to bring it about that $\mathbf{P}$ in $\mathbf{C}$.

If there is no such executable for α in $\mathbf{C}$, then α has an *inability* to bring it about that $\mathbf{P}$ in $\mathbf{C}$.

[3]For more on volitions and the motivating complexes that cause and rationalize acts, see [6].

3 Extending the IPT Analysis

In earlier work on IPT the focus was on the meaning of movements and on accomplishments that changed circumstances external to the agent. To cover the full range of inabilities and disabilities, we need to treat accomplishments that change the circumstances internal to an agent, and we need the concept of *enablement*.

3.1 Epistemic accomplishments

Consider what is involved in a sighted person who is a competent producer and interpreter of English using vision to access information expressed in English on a computer monitor. The person turns towards the monitor, opens his or her eyes, and focuses them. In certain circumstances, the room being lit, for example, this will bring about certain results. The person will have richly structured visual sensations and as a result of various complicated processes, pick up the information on the monitor—that is, the person will 'see' what it says. The movements, turning towards the monitor, opening the eyes, and focusing, were modes of bringing about this succession of internal results: visual sensation and perception, which are in turn conditions for interpreting the text displayed on the monitor.

This method of getting information from a printed page depends not only on external circumstances, such as the room being lit, but also on internal circumstances. The visual system must be intact and whatever is required for the interpretation of the sensory input must be in place. Of course, there are other ways of finding out about the semantic content of the text on the monitor. Blind persons, who are unable to access the information in the way sketched above, can use any of the following:

- Get someone to read the material to them and use their hearing.
- Use a text-to-speech synthesis system and, again, use their hearing.
- Assuming they can read Braille, transcribe the text into Braille and use their hands and fingers to access the information in this new format/medium.

In each case, the blind person can achieve the crucial cognitive accomplishment of accessing the information displayed on the monitor—something the sighted person does by reading the display page—without doing so or being able to do so.

3.2 Circumstances of an agent vs. circumstances at a location

When we think about the circumstances in which, say, executing a certain movement type is a method of accomplishing some result, we see that these can be

usefully decomposed. One simple mode of decomposition is suggested by the following. Included in these circumstances will be an agent being at a location at a certain time. The relevant circumstances, then, will be the facts about the agent, the facts about the location, and the facts that derive from the agent being at the location. This decomposition is analogous to that of the context of utterance into those features that are internal or essential to the identity of the utterance—the agent, the spatiotemporal location—and other wider features of the circumstance in which the utterance is performed.

The facts about the agent include both facts about what other executions the agent is performing and about what its internal state is. In this regard, we need to keep in mind the two ways in which the internal states of an agent help to determine what that agent accomplishes. First, some of these states, what in [6] we called the motivating complex, will cause the execution of the movement. Second, some will be among the circumstances that determine what epistemic accomplishments result from an execution. It is the second only that we consider part of the circumstances of the action. The circumstances at the location include everything else that mediates between action and action.

3.3 Enablement

Much of what we do is done with an eye to making other things we want to accomplish possible. We do something that changes the circumstances so that ways of doing things are available that were not available before. Consider sending email by depressing the "s" key on your keyboard.[4] Note that turning on the computer or even composing a message in your mail program are not ways of sending email, though they may be said to be parts of the action of sending an email message.[5] Rather, the computer's being on and your having composed a message in your mail program are necessary conditions, not just for sending email, but for your depressing the "s" key to be a way to send email (indeed to send that very message that you've composed), and for your moving your left hand and, in particular your ring finger on that hand, to be a mode of sending email. And they are necessary conditions that can themselves be brought into being by doing things.

We say that one action (execution or accomplishment) *enables* an another, typically an accomplishment, relative to a circumstance, $\mathbf{E}(A, \mathcal{B}[Q], \mathbf{C})$, if and only if

- $\exists A'$, $\mathbf{P}$ such that $WO/MO(A, \mathcal{B}[\mathbf{P}], \mathbf{C})$
  & $WO/MO(A', \mathcal{B}[\mathbf{Q}], \mathbf{C} \wedge \mathbf{P})$

[4] We assume here that you're using "mh" as your mail system.

[5] When people speak of parts of plans or of procedures, they may mean any of a number of things: in particular, they may be referring to an enabling action or to an action that is a way of doing something else importantly related to the goal of the action or procedure.

In our case, let the initial circumstances ($\mathbf{C}$) be that you are sitting at a computer that is already turned on and that you are using your mail program. In these circumstances you can move your fingers in certain ways (A) and thereby compose a message $\mathcal{B}[\mathbf{P}]$. Adding this accomplishment to the circumstances gives us $\mathbf{C} \wedge \mathbf{P}$. In these new circumstances there is something, namely depressing the "s" key (A'), that is a way of sending the message. So moving your fingers in a certain way enables you to send a message, although it doesn't by itself constitute sending the message. You may be all ready to send it, and then think better of it.

4 Design Principles

In the discussion above, we assumed the existence of a great deal of technological infrastructure—the existence of computers and networks of computers of various kinds, and of certain types of software. If these weren't available, none of us would be able to send email messages. There is also, of course, the existence and well-functioning of the larger electrical systems within which the computers live. The existence of this infrastructure can be said, in turn, to be an *enabling condition* of all our computing activities. This is quite typical: something the agent does is enabling only in circumstances in which enabling conditions have been established by the society, that is by the culture and technology the society has produced.

In the modern world, the things an agent can do are most often not merely a product of the movements the agent can execute, but these combined with various artifacts: structure and equipment provided by human beings. Broadly speaking, one can distinguish between the infrastructure at a location, and the equipment that an agent has. When we drive or bike to work, for example, the roads from Palo Alto to Stanford are parts of the infrastructure provided at these locations. The cars and bikes we use are part of the agent's equipment.

When infrastructure is provided at a location in order to make it possible for agents to achieve certain goals, there is a presupposition about what the agents can do, the abilities they bring with them to the infrastructure. A stairway, for example, seen as providing a way of moving from one level to another in a building, presupposes the ability (roughly) to lift oneself eight inches. This is most naturally done with the legs, but can be done with the arms, and also with some very high-tech wheel-chairs. A ramp, provided for the same purpose, only presupposes the ability to move forward, something that can be done by walking or by using an ordinary wheelchair.

The presupposed abilities are the ones that are necessary to *interface* with the infrastructure, to make use of it for the purpose in question.

Consider again the case where it is essential that people be able to move between floors in a building—typically as an act enabling further, doubtless more important accomplishments. Suppose the architects made a bizarre mistake and

forgot to put in stairs. No one except dedicated wall-scalers can get from one floor to another. Then stairs are installed between floors. This changes the circumstances at the location and this change enables anyone who can climb steps to move between floors. Almost anyone who can walk can climb steps, though the bipedal movement types involved are actually different. And, of course, we are assuming the stairs are well-designed to enable most people to use them. Unless the stairs are very wide and shallow, though, it will be hard for people walking with the aid of crutches to use the stairs. Further, some who can't walk can use stairs as well, for example if they can crawl on all fours and lift their upper bodies sufficiently. So some people will walk; some will crawl; who knows, perhaps, some will walk on their hands—all, in their different modes, are now able to move between floors. The stairs provide enabling conditions in which all of them are able to do something they couldn't do before, at least not in the preexisting circumstances at that location.

Still, some are left out; those who can't both move forward and lift their bodies sufficiently. Let us call what the walkers, crutch-assisted or not, and the crawlers can do *moving point to point and lifting*; perhaps there are others who can can only *move point to point*. Both of these are accomplishments, not executions; they are accomplishments which can result from executions of many different movement types. Given (normally designed) stairs at a location and relative to the desired accomplishment of moving between floors, moving point to point and lifting is what we shall call an *interfacing accomplishment*. In those same circumstances and relative to that desired accomplishment, simply moving point to point is not an interfacing accomplishment. In building the stairs, the engineers can be thought of as changing the circumstances at a location in a way that allows the extension of previously existing way-of relations, at that location. Anyone who had a way of moving point to point and lifting, now has a way of moving between floors at that location. Thus it makes sense to build stairs because we can assume that the majority of people who need to move between floors will, independently of the stairs, have the ability to move point to point and lift.

Now suppose we have an agent who has no way of moving point to point. By acquiring a wheelchair, this person obtains a way of moving point to point. It is important to do this because moving point to point is an accomplishment that interfaces with many other accomplishments and more broadly with many other *methods*, but not with that of moving between floors, at least not if all that is provided at a location are stairs. In order for moving point to point to be a way of moving between floors something like a ramp is necessary—something that obviates the need to lift. With a ramp, moving point to point is an accomplishment that interfaces with the desired accomplishment; it became of way of moving between floors and thus part of a method for, e.g., hand delivering memos to one's boss.

Now let us consider the relation between walking, walking with crutches and using a wheelchair. Here we include in walking the variation that results

in climbing stairs. An agent equipped with crutches is given a new way of walking. That is, walking is not itself an execution, but an accomplishment that standardly involves the execution of a number of movements in a coordinated way. Someone who can execute some but not all of these, or lacks strength or balance, can accomplish the same thing using crutches. Walking is an interfacing accomplishment for many methods and in a very wide range of circumstances. For most of these, walking is first and foremost a way of moving from point to point. Thus, an agent equipped with crutches will interface the various walking-involving methods at the same point as the individual who walks without crutches.

In contrast, the wheelchair user is not provided with a new method of walking, but a new method of moving from one point to another that does not involve walking. Using a wheelchair does not interface with the various walking-involving methods at the same point as walking. It interfaces rather at a slightly more abstract level, precisely that of moving point to point. This is more abstract because both walking and wheeling are ways of moving point to point.

Consider a task such as delivering inter-office memos. Suppose the standard method of doing this in a company is hand-delivery; that is, the messenger picks up the memo from the writer, walks to the office of the intended recipient, and hands it to her. The circumstances at the locations determined by the paths to be taken need only enable walking. This method is essentially unchanged if a crutch-user user becomes the messenger. In the case of the wheelchair user, the paths must enable point-to-point locomotion by wheelchair; typically at least, a wheelchair-accessible path is one that enables walking. Designing and building walking paths in such a way that also renders them wheelchair accessible—and this may, of course, include providing ramps—enables a larger, more abstractly characterized, range of interfacing accomplishments. Providing crutches, while a good thing, does not in this way enable a large range of interfacing accomplishments at a location. Rather, it changes the circumstances of an agent, leaving wider circumstances as they were. Notice that is even more so with respect to providing prostheses, such as artificial legs.

The principle that urges such design we call *generic interfacing*:

- Design so as to enable the widest possible range of interfacing accomplishments.

Let us look at another case, one closer to the central focus of the Archimedes Project, a research project at Stanford University whose mission, in part, is to help people with disabilities to communicate and to have access to information through the development of computer technology (see box).

The Archimedes Project is a project at Stanford whose mission is to provide individuals with disabilities access to computers and access to people through computer technology. The Project is based on the philosophy encapsulated in the following six principles:

- Everyone requires help in gaining and effectively using information, not only those individuals who have disabilities.
- In itself, information is neither accessible nor inaccessible; the form in which it is presented makes it so.
- To be disabled is not necessarily to be handicapped. Handicaps can often be removed where disabilities cannot.
- Handicaps often arise from decisions to design tools exclusively for individuals with the standard mix of perceptual and motor abilities.
- Designed access is preferable to retrofitted access.
- Solutions that provide general access can benefit everyone.

Further information about the project is available on the web: http://www-csli.stanford.edu/arch/arch.html.

Consider a computer. The standard method for inputting data to a computer is by typing on a keyboard and moving a mouse that are properly attached to the computer. We have:

moving fingers → typing → inputting data → creating/altering files → (many applications)

Keyboards were designed as they were to enable typing as the standard interface accomplishment for a wide range of computational accomplishments and methods. But by using a head-stick, holding a pencil with one's teeth, using one's feet, etc., one can fit into this method at the typing node—that is, all these are modes of depressing the keys in such a way as to bring about all the required computational events. Use of speech recognition technology, on the other hand, allows one to interface this method at the inputing data node, bypassing typing altogether. It renders talking an interface accomplishment relative to the same extremely broad class of accomplishments and methods for which typing and mouse moving were the sole interfacing accomplishments. Thus, the provision of speech recognition technology provides for a wider class of users by enabling a larger class of interfacing accomplishments.

Finally, let us return to the case of the epistemic accomplishment of obtaining information from a display on a monitor. We were supposing our blind reader was dealing with a not quite modern system, in particular a pre-GUI system, one in which all the information to be displayed could be (and was) displayed on the screen via text. In the world after the GUI revolution, provision of screen readers and/or Braille transcribers is no longer enough to render hearing and feeling adequate interface accomplishments, relative to the new, even wider range of accomplishments and methods available to the sighted.

Interaction with computer systems is aimed, first and foremost, at interfacing with the meaning of or information carried by files—which we use as a maximally generic term for data structures. The principle of generic interfacing suggests the following design principles with respect to computer systems: make both input and output as device-neutral as possible, that is, bypass as much as possible the requirements (on executions) of particular peripheral devices. This is typically accomplished by providing alternative peripheral devices enabling other input/output modes. But this depends, in turn, on the form in which the information is carried being accessible to those modes. To the extent that the GUI revolution narrows the interfacing accomplishments for interacting with computers to visually picking up graphical information and pointing with a mouse, it represents a violation of the principle of generic interfacing.

5 Conclusion

We have indicated how reflection at a theoretical level on the nature of the problems of individuals with disabilities provides a useful set of issues for those interested in the structure of information and action. But can such thinking be of any real use in improving the world for individuals with disabilities?

As we noted at the beginning, the circumstantial conception of disability and handicap provided part of the philosophical basis for the ADA. The IPT account of the structure of action, which emphasizes the importance of circumstances, has allowed us to develop that conception, and isolate, with the concept of generic interfacing, an important abstract principle of design.

But would we want to enforce a design principle that could have ruled out or delayed the GUI revolution that has provided benefits for so many users?

The problem with the GUI revolution was not what it provided, but what it took away. It provided people with graphically based presentations of information and mouse-based control. But in many cases, the implementations took away the alternative methods of presentation and control that blind users depended on.

Suppose that the designers of the GUI had been encouraged, through education or the requirements of law, to design within a broad conception of information and action that focused on information and accomplishment and emphasized principles like that of generic interfacing. Such a mind-set on the

part of the designers responsible for the GUI revolution might well have led to creative attempts at providing alternative access at a much earlier state of the revolution than actually happened. (In fact, a program that provides moderately good access for blind users to Windows 3.1 was put on the market at about the same time as Windows95, which made it obsolete.)

Such a design conception might also have motivated earlier and more concerted theoretical research into such issues as the equivalence of information presented in different modalities and the optimal presentation of information when a mixture of modalities is available—issues that are important to today's designers working on products for non-disabled users who want to do email and browse the internet by phone, for example.

Thoughts such as these make us cautiously optimistic that theorists of information might conceivably provide something of use to individuals with disabilities. In particular, we think a more fully developed account might be useful in untangling some of the more thorny issues currently being raised in connection with the ADA, especially those related to adaptive computer equipment.

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