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ANIMATION OF ADVICE LEAFLETS USING HYPERTEXT AND KNOWLEDGE BASED SYSTEMS TECHNIQUES

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Summary

One important aspect of law is the dissemination of information to those who are affected by laws, so that they can be aware of their rights and duties. A popular method of dissemination is the advice leaflet, which explains the import of a particular item of law. Sometimes these leaflets are produced by Government, sometimes by privatefirms of accountants and solicitors. The object of such leaflets is to enable their readers to understand the area of law, and its impact on them, so that they may take informed action. To this end not only is the text critical, but so too is the ability to apply the general principles explainedin the text to the particular circumstances of thereader. In this paper we describe a method of animating such leaflets using an intergration of hypertext and knowledge based system techniques, which will at once respect the text and tailor it to the needs of the reader.

1. Introduction

Expert systems have the potential to support a variety of tasks relating to the legal domain. Much attention has focussed on the provision of support for adjudicators and advisors, but another important task is that of informing lay members of the public as to their rights and duties. This is particularly important in the field of transfer pay-ments - tax and welfare benefits - where public awareness of their rights and obligations are crucial to the smooth functioning of the system. In these areas it is important that citizens understand the effect of the law as it applies to them: welfare benefits must be claimed, and taxable income declared. Currently the main burden of disseminating such information falls on advice leaflets of one form or another. These leaflets contain a simplified exposition of the law, and are often associated with a form, claim forms in the case of welfare benefits, or forms declaring income in the case of income tax. A further type of leaflet gives assis- tance when difficult choices are to be made, such as when people are to begin a period of working abroad and need to know how they should arrange their affairs with regard to tax. Often citizens will need to seek further advice, but without some understanding gleaned from the advice leaflet they will not know of this need for advice, nor be likely to assimilate advice when given. Given the widespread use of such leaflets in providing information to members of the public, we believe that a system which is intended to support the dissemination of such information must start by taking these leaflets seriously.

Two things are critical: first that the readers of the leaflet should gain some understanding of the area of concern, since they are discharging a legal action for which they must take

responsibility, and second that they should be in a position to attempt to apply this understanding of the general provisions to their own particular cases. Where advice leaflets have been used in the past, they have normally been used only as a source of information to be restructured as the knowledge base of a conventional consultative expert system. This is less than satisfactory, however, since the oracular nature of such systems may leave users with an answer meeting their circumstances, but only an imperfect understanding of how that answer was arrived at. Such systems therefore undervalue the text. Moreover this lack of understanding militates against the ability of the user to answer correctly questions posed by the system, and there must therefore be a corresponding doubt in the answer given by the system. In this paper we describe a system which animates these leaflets in a way which makes manifest the implications of the legislation for a particular case through the use of an underlying executable model. The resulting system provides all the advantages of the traditional expert system, but in a way designed to promote understanding through giving due weight to the text.

2. Problems with Advice Leaflets

Before going on to describe the system, however, we should briefly review some problems with advice leaflets which lead us to think that the leaflets require animation. When composing advice leaflets a number of difficult choices need to be made, which tend to reduce the efficacy of such leaflets. Among the major problems are:

Detail problems: Only a certain amount of detail can be included in a leaflet if it is not to become unacceptably long. This means, to take an example, that if it is important whether a person lives in an E.E.C. country, a Commonwealth country, or elsewhere, these are the terms that are likely to be used because to list all the individual countries would result in confusion. Not listing the countries, however, does require that the reader know which countries are members of the various organisations.

Thesaurus problems: sometimes different people will typically associate a different term with some key concept used in the leaflet. Thus in the case of Sickness Benefit there is something called a "Doctors Statement" which is often referred to as a "Medical Certificate", a "Doctors Certificate", a "Certificate" and a "Sick Note". Clearly the leaflet needs to settle on one of these terms and to use it consistently. Since, however, misunderstanding will result if the reader fails to respond to the term used, this is less than satisfac- tory.

Overlap problems: often the leaflet will need to refer to some other area of law in the course of its explanation. Duplicating this in the leaflet would make the leaflet unwieldy, and so there is usually cross reference to some other leaflet or leaflets. This is, however, frustrating when these leaflets are not immediately available.

Different circumstance problems: typically the law will need to cover a number of different circumstances; the married and the single, those with children and those without, the old and the young. Where different provisions apply to different groups, the result will be that much of the leaflet will be irrelevant to a given reader. Picking a way through the leaflet so as to find all and only the relevant material is a non-trivial task, and a reader may well get confused by irrelevant material, or miss something that does matter. Use of the information: when they have read the leaflet the readers need to be able to go on to apply the

information to their own cases. Where this is complicated - as it often is in such areas of law - they may either fail to apply some rule, or misapply some rule. Moreover, when they go on to complete the associated form, they may well have difficulties in relating a particular entry of the form to the correct part of the document.

Let us now consider how we could address these problems.

3. A Hypertext Solution?

Many of the above problems would seem made for treatment by presenting the leaflet in the form of a hyperdocument. Terms such as "EEC" might be highlighted so that that the readers can obtain a list of the relevant countries if they need them, whilst the document remains uncluttered by those details for those who already know this information. Similarly thesaurus problems can be avoided in this way. Essentially the problems arising from the need for the author to choose what information to present are avoided since the readers can choose the information they want and need. Overlap problems are also addressed by hypertext: links between various leaflets describing related areas of law can be provided so that the readers may traverse between the leaflets smoothly without ever being faced by anything too unwieldy. The need to cater for different circumstances can be met by providing different routes through the hyperdocument to be followed by the readers in the light of their own circumstances. Links between form boxes and the appropriate paragraphs can help too.

Thus in many ways presentation as hypertext will enable readers to access the information in a way which will help them to assimilate it, and so gain a more effective understanding. It is not, however, by itself adequate since it fails entirely to support the application of this general understanding to their own particular circumstances. What is needed therefore is a way of animating this hypertext by providing an underlying model to act as an expert system which will apply the implicit relations described in the document in the light of facts supplied by the reader.

4. Coupling Hypertext to an Expert System

We thus propose that the hypertext be animated by the use of an underlying expert system. This will model the relationships between the concepts used in the text, so that dynamic customised information can be provided for the reader. The underlying expert system could use any desired knowledge representation: our preference is for predicate logic. We propose a close coupling of the hypertext and expert system, implemented along the following lines. Where an item of text corresponds to an attribute used in the expert system the hypertext will contain an additional node. This will represent the value of that attribute: accessing this node will give the reader information as to what the currently believed value of that attribute is. From this node the user may enter a value for that attribute, or, if the value is unknown, request the system to discover the value of that attribute. Adding a value will cause the underlying rule base to forward chain to potentially set the values of other attributes, which will then be recorded in the appropriate value nodes of the hypertext. Requesting a value will ini- tiate backward chaining in the expert

system. This will produce a question for the reader to answer: the reader will be taken to the appropriate value node and invited to assert a value for the corresponding attribute. Backward chaining will then proceed until the goal is solved or an impasse reached.
An example will illustrate the process. Suppose we have the following piece of advice concerning retirement pension:

A person is deemed to be retired if he has elected to retire, or his age is more than five years over pensionable age. Pensionable age for a man is 65 years and for a woman 60 years.

This could appear in hypertext form as:

A │person│ is deemed to have │retired│ if he has

│elected│ to retire, │ or his │age│ is more than

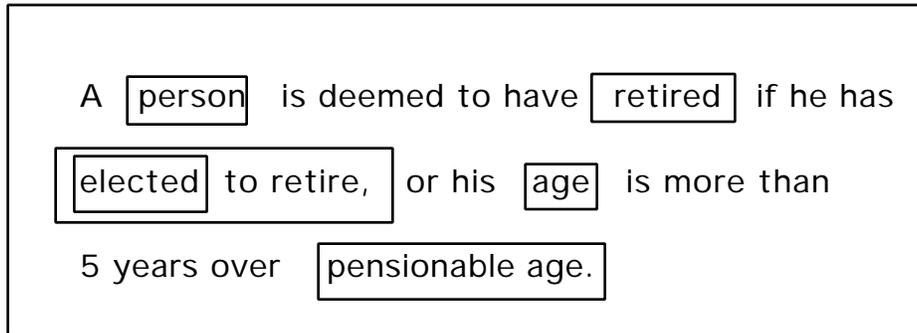5 years over │pensionable age.│

Figure 1:

Words in boxes are active, and have links to other nodes in the text. Buttoning on a box will display a menu of links to be followed. Thus buttoning on "elected" will give access to a synonym such as "chosen", buttoning on "elected to retire" will provide a link to the leaflet which explains the procedure for doing this. Buttoning on "pensionable age" produces the following:
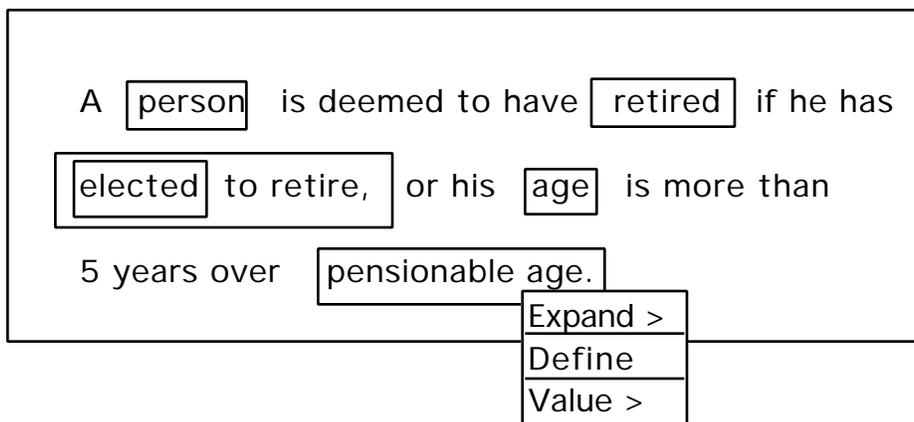
A │person│ is deemed to have │retired│ if he has

│elected│ to retire, │ or his │age│ is more than

5 years over │pensionable age.│
                                  Expand >
                                  Define
                                  Value >

Figure 2:

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The arrows in the menu options mean that further options can be obtained by dragging to the right. Thus for the expand box:

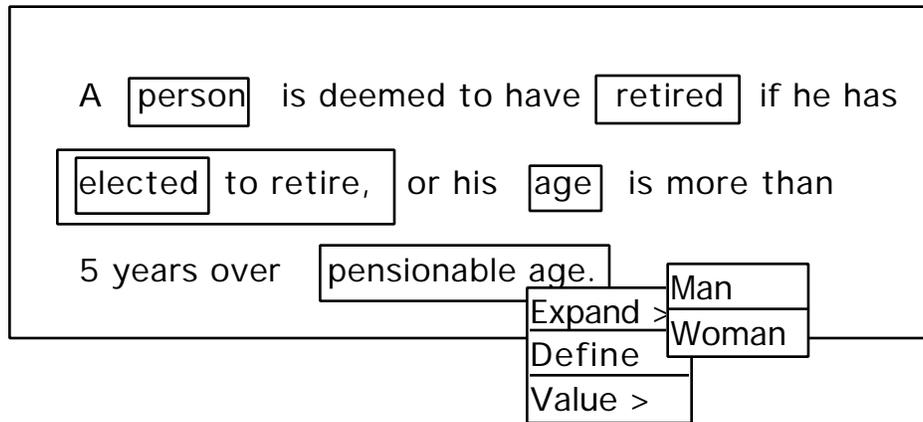A [person] is deemed to have [retired] if he has [elected] to retire, or his [age] is more than 5 years over [pensionable age.]

|Expand >| |Man|
|Define | |Woman|
|Value > |

Figure 3:

Selecting "man" at this point will give access to the node which explains what pensionable age for a man is:

[Pensionable age] for a [man] is 65 years
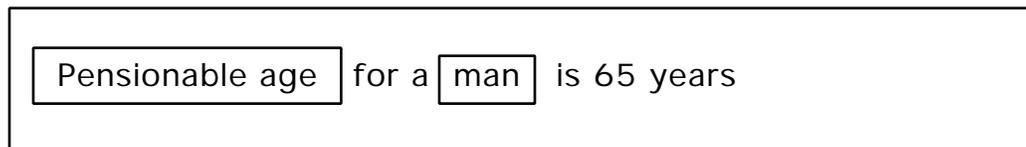
Figure 4:

At this point readers may wish to assert their sex. Buttoning on "man" will give the opportunity to do so:
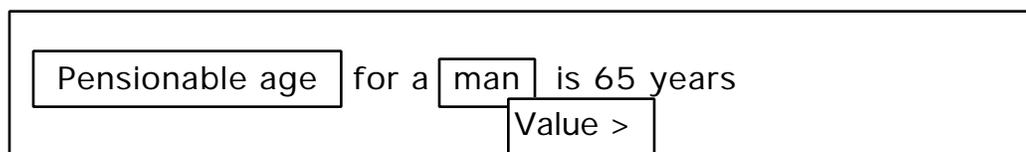
[Pensionable age] for a [man] is 65 years
|Value >|

Figure 5

Dragging out from "value" produces the following display:

[Pensionable age] for a [man] is 65 years
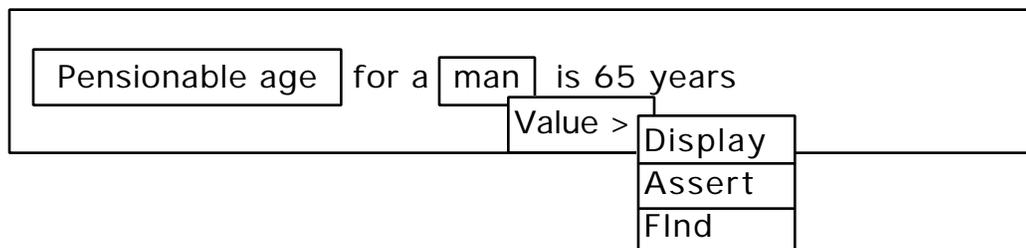|Value >| |Display|
         |Assert|
         |FInd|

Figure 6

Here they may inspect the current status of the predicate, supply a value, or initiate backward chaining by requesting that the system find a value for the predicate. Suppose that the reader is a woman, and tells the system so, by asserting
false here. Now given an underlying rule base such as:

```
deemed retired(X) :- elected to retire(X).
deemed retired(X) :- age(X,A),

 pensionable_age(X,B),
 C is A - B,
 C > 5.
pensionable age(X,65):- male(X).
pensionable age(X,60):- female(X).
```

The system can conclude that the pensionable age of this person is 60, and no more. Accessing the value node associated with pensionable age and choosing the "display" option will now tell the reader that the relevant age is 60. But what the reader really wants to know is whether she is deemed to be retired. She therefore accesses the value node of "retired" and chooses the "find" option. Backward chaining the system will first ask if she has elected to retire.

Have you [elected] to [retire] ?
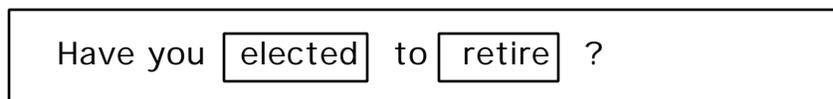
Figure 7:

Note that any synonyms and other additional information will be available to the user from the hypertext at this point. Suppose she says that she has not. The system will now invoke the other rule and ask the reader for her age. If it is greater than 65, the value true will be assigned to the value node associated with "deemed retired": otherwise false will be placed there.

Whilst is is not expected that the reader will require such assistance in this simple case, the principles are made clear by the example, and the benefits on a realistically sized fragment can readily be imagined.

5. Discussion

What is novel about this system is that it provides an effective interface to an expert system which can supply answers relevant to the individual's circumstances, while retaining the primary function of the advice leaflet which is to provide an understanding of the area of law under consideration. This understanding is additionally enhanced by the purely hypertext facilities offered. A more standard approach is to use the expert system as an interface to the hypertext (e.g. Barlow et al 1989), the role of the hypertext being to explain the conclusions of the expert system. We believe that this fails to correspond to the motivation of advice leaflets: the text must remain the most important thing, although understanding will be re-inforced by seeing the precepts dynamically applied as information is entered or requested. As an additional advantage any claim form associated

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with the leaflet will be completed through the appropriate value links in the course of the session.

It is worth noting that, as with hypertext documents, the animated leaflets described here can be created either by enriching an existing leaflet with hypertext, animation and form-filling features or by authoring such a document from scratch. Where high quality texts exist, such as for advice leaflets produced by Government or other professionals, the former approach has considerable advantages. Where such texts do not exist, for example for new legislation, the latter approach may be appropriate. Hypertext and multimedia authoring tools (see eg Fountain et al, 1990) can be adapted with either approach to produce a suitable document structure for animation by an underlying expert system. There seems to be no reason, therefore, why our animation techniques should not be applied usefully to other domains such as medical diagnosis and management, motor car maintenance and so on.

The smooth functioning of law in a modern society requires an informed citizenry: we believe that the animation of advice leaflets in the manner described above could provide a valuable tool in achieving this end.

6. References

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