DynEST - Dynamically Explained Symbols for Traffic Or Learning How to Drive Without Words

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Abstract: Traffic signs and rules play an important role in our daily life. Knowledge of them is crucial for surviving. However, every country has its own traffic regulations and they often differ in subtle ways. Also, the official traffic regulations are often rather hard to read and comprehend for the average person. In a time of globalization when more and more people live or travel abroad there is a growing need for a universal tool which would easily explain differences between the traffic regulations in various countries. Due to the internationality of such a tool, the choice of language represents a huge problem. In this paper we present DynEST, a unique software solution for this problem. DynEST explains traffic regulations without words, just using dynamic i.e. animated symbols. A simple yet powerful architecture of the software provides great flexibility for e.g. cross-comparing any two countries in the world. We hope that DynEST is a first step towards a European driving license and more security in traffic.

Introduction

We are all familiar with traffic signs and rules as they are crucial for our survival. Since our childhood we are confronted with parts of the traffic regulations. Our knowledge about these rules keeps growing as we become adults and obtain our own driving license. However, this knowledge is usually bound to the laws of the country we live in. When traveling, we also need the knowledge of traffic regulations and informal road rules in other countries. It is often almost a culture shock and unexpected that traffic regulations differ from one country to another. However this shock is not the worst thing that can happen to us. For example, in some parts of Canada and the USA it is allowed to make a right turn on a red light after we have come to a complete stop. In Austria this is not allowed. Just imagine what could happen if we try to make such a right turn in Austria! It is obvious that not knowing the traffic rules of other countries can be expensive (in terms of police tickets), but even more important, dangerous or even fatal. Unfortunately, the efforts towards internationalization and unification of traffic rules have not fully succeeded, so far.

Thus it is important to cope with the unfortunately existing differences. An obvious solution lies in using computer. Computers and software are certainly powerful enough to implement complete software solutions for learning how to drive. Indeed, there are already many software programs offering partial solutions. However, these programs all have one big disadvantage - they explain traffic rules and signs only for one country and, even worse, most of them explain the rules only in the language of that particular country.

It is interesting that no software solution seems to exist yet which would show and explain the differences in traffic rules of two or more countries. We believe there are two main reasons for this. First, there is the problem of language. Second, the problem is also one of size of effort: it is a big undertaking to search trough road rules from several, or maybe even all, countries of the world, to determine the differences, and then explain them in many different languages.

Let us first discuss the language issue in more detail. In the European Union, and especially since the Eastern enlargement of the EU, the problem of the variety of different languages in many areas of our lives poses tremendous problems. An obvious example for this is legislation in the EU. The same problem occurs in our above mentioned software solution if we try to internationalize it. Of course we could try to use English since many people know this language to some extent, but can we really expect from everybody (!) to know English well enough to understand some of the more subtle issues? Descriptions of traffic situations may often be complicated and contain some special wordings. On the other hand, to translate our complete software to all languages is also more or less out of the question. It is thus obvious that we need something better.

It is often said that an image can tell more than thousand words. Thus it is natural to use the power of images, especially of dynamically moving images i.e. animations for explaining complicated traffic situations. In this case we can make use of much of the research in the field of dynamic symbolic languages. We will explain more about dynamic symbolic languages in the second section of this paper. Keeping in mind dynamic symbolic languages we have implemented DynEST - Dynamically Explained Symbols for Traffic - a demo version of the solution proposed in this paper, which we will explain in more detail in the fourth section of the paper.

As a first step towards an international and easy to understand solution, DynEST proves that the differences between road rules of different countries can be explained by the use of symbolic dynamic languages instead of words, or at least using very few words (that then may need translating).

Visual Languages

Explaining complex traffic situations without words is rather challenging as they are usually explained by means of a mixture of words and pictures. Since we need powerful tools to help us represent the ideas to users it is natural that we base our approach on what is known from symbolic and visual languages. Hence we give a brief introduction to this topic in this section. However, we refer to the special issue of the Journal of Universal Computer Science (JUCS 2003) for more details. According to (Maurer et al 2003) the main idea of visual languages is to replace words by graphic symbols. Since the beginning of humankind people have communicated by means of graphic symbols, even centuries before we started to write. With images we can often express more content and represent this content in a more compact manner than with words: if the image is done well it conveys its meaning instantaneously. Thus we believe that in many situations it is more natural for us to communicate with graphic symbols than with words. There is another very important issue first explicitly noticed already almost 70 years ago (Neurath 1936): if we hear a word in a language that we do not know, we will usually not remember it for a long time. If we see a symbol, it may well require that someone explains to us what it means (only few symbols are obvious enough not to need any explanation!). However, once we have understood the meaning of a symbol it seems to stick in our memories forever. Let us try an example: the word “eye” in Italian is “occhio”. If you do not speak Italian and you have not heard the word before our bet is that you will have forgotten what “occhio” means within days, if not earlier. The symbol for the word “eye” in one of the most successful symbolic languages, BLISS (Bliss 1984) is a circle with a dot in the middle (the dot symbolizing the pupil of the eye). Try to visualize this symbol for a moment. We claim that if you see this symbol even in months you will remember that it is the symbol for “eye”.

A very important question concerning visual languages is the design of graphic symbols. It is obvious that symbols used in a visual language should be easily understood. In order to make a powerful language we should also be able to combine symbols to describe attributes and to create compound symbols to represent new meanings an approach called “orthogonality” in program language design as early as 1967!.

When speaking about application of visual languages in a computer system the graphic symbols are usually used as icons. An icon can be described as an image which represents any object by giving us information on this object. According to (Jonassen et al 1996) there are three ways in which icons communicate graphically to us:

Representational:
This kind of icons try to represent the object in a straightforward fashion. However, this often leads to the fact that they are not so easy to produce. For example an icon of a house on a map can be used to represent the position of user's home.

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This kind of icons are already more abstract and arbitrary then representational images. However, they still bear some resemblance to the object or idea which they represent. Many traffic signs, like the "watch out for the bend in the road" sign, or the sign for "airport" that is used all over the world are a good examples for such icons.
Symbolic:
These do not necessarily bear any resemblance to the object or idea they represent. In that sense they are completely arbitrary. Our alphabet is an example for symbolic icons.

Furthermore there are three types of icons: static, dynamic and animated icons. Static icons do not move nor change their form, shape, color or any other attribute. Dynamic icons can either change their form, shape, color, content or they change their position on the screen. Finally, animated icons can be seen as a short animations i.e. like movies on the screen. (Jonassen et al 1996). Returning to visual languages, there are static visual languages, those with animated icons and finally visual languages with structural dynamics. The main difference is that static visual languages and those with animated icons have no elements of change and/or movement on a structural level. This means that in dynamic languages the change carries the most of the meaning in the linguistic sense (Maurer et al 2003).

In DynEST, our demo version, we mainly use abstract static, dynamic and animated icons for both the graphical interface and also for representing traffic signs, road rules and other parts of traffic regulations. We however concentrate mostly on animated icons as they offer great flexibility of representation. Furthermore animated icons are more easily understood and more suited for explaining traffic situation then visual languages with structural dynamics. In the next section of this paper we willl briefly discuss traffic regulations around the world with emphasis on the various regulations in the countries implemented in the test version of DynEST.

Traffic Regulations

The main question of this section is how much traffic regulations differ around the world. It turns out that we can find most of the differences in specific details and less in "central parts" of the traffic regulations. Despite country-specific differences we can distinguish between several main categories of traffic regulations.

We want to emphasize that going through all traffic regulations is a major undertaking which cannot be done by one or two persons. Therefore our research is not encyclopedic. In this section we just summarize the results of our investigations by briefly discussing traffic signs, traffic rules, traffic lights and road markings as most important parts of traffic regulations.

Let us start from the most obvious difference, the side of the road we are supposed to drive on in a specific country. It is interesting that almost 3/4 of world population drives on the right side of the road. In Europe there are only four countries which drive on the left side: Great Britain, Ireland, Cyprus and Malta (WS 2005). On the other hand, in the worlds second and third largest countries (by inhabitants), i.e. India and Indonesia, left hand driving is the rule. And there is, a curiosity, at least one country where we usually drive on the right but on certain road sections we have to drive on the left: Brazil is such a country! (The reason for this is that when planning the capital of the country, Brasilia, efforts where made to provide free flowing traffic without traffic lights: this has lead to a number of curious but ingenious solutions!)

Traffic signs

Traffic signs are used for warning drivers and giving them information. In all traffic regulations we can distinguish between three types of traffic signs. First there are warning signs. Warning sings tell you that there may be some danger ahead. In most countries these signs are a triangle with red border. Depending on the country the background of the triangle can be white (Austria, Argentina), orange (Croatia, Slovenia) or blue (parts of South Africa). In parts of the United States, Australia and New Zealand warning sings have diamond shape with black border. The background of such signs is usually yellow. It is interesting that in China warning signs seem to combine these two designs. Warning signs in China are triangles with yellow background and black border (China 2005).

Secondly, there are regulatory signs. They tell you about laws you have to obey. Regulatory sings can have the form of a circle with red border on white (Great Britain, Austria) or orange (Croatia, Slovenia) background. In the United States and Australia most regulatory sings are represented by a rectangle with black border on white background and with black text. In contrast to other countries these signs often use words to communicate instead of symbols (Traffic 2005), (DSA 2004), (Australia 2005), (USA 2005).

Finally there are information signs. In almost all countries these sings are rectangles. Background color depends on two factors: country and meaning of the sign. For example highway signs are mostly green (Croatia, Slovenia) or blue (Great Britain, Austria, Germany). Signs conveying tourist information are mostly brown as for example in Great Britain and in the United States. (Bartolomeo 2005), (Traffic 2005), (DSA 2004), (Australia 2005), (USA 2005). The signs for "Kangaroos next 5 miles" or "Watch for cows on the road" are similar and hence easily understood, but the strange sign indicating that you are merging into a major road that is used in Oman is a sign nobody from central Europe will have ever seen before!

Traffic rules

During our research we have come to the conclusion that there are two categories of traffic rules: rules for driving as such, for example precedence rules, and rules defining the driver's environment, for example traffic penalties or alcohol levels permitted.

As we mentioned at the beginning of this section most differences can be found in small and specific regulations of traffic regulations. The rules defining pedestrian crossing, driving, parking etc. are almost identical across countries. There are only slight differences in precedence regulations and permitted driving speeds, however they may be very dangerous if one is unaware of them. One of the most dangerous differences we have come across are the rules of precedence when two cars driving towards each other want to turn into the same road at an intersection without signs or traffic lights: in Austria and many other countries the car with the smaller turning radius has precedence, in New Zealand it is the other way around! More than one collision of a local with an Austrian or German tourist has resulted from this fact in New Zealand!

Traffic lights

There are no major differences concerning traffic lights either, but again some with potential serious consequences. The sequence of the lights is the same in all countries. However, there are some surprises: most countries do not have enlarged red lights as is common in Austria. Austrian traffic lights are also different in other ways: for example, their green light blinks before they turn yellow and then red. Tourists not aware of this may be confused and may brake hard. An Austrian driver behind would still expect to make the crossing, hence is likely to bump into the car stopping (for no reason) in front! The blinking of green lights (to signal an impending change to red) is comparable to what is done in many places in the US: a second set of lights before a major intersection starts flashing, when the light at the major intersection is about to turn red.

Road markings

In most countries road markings look similar. However, there are exceptions like the markings for diamond lanes in USA (Rideshare 2005) indicating that such lanes can only be used by buses, cabs and cars with at least two (in some cases at least three) passengers. The lanes reserved for buses and taxis that we can find in countries in Europe serve an analogous function, but do not allow even fully loaded private cars to make use of them. We can also find interesting road markings in England for clearance zones and mini-roundabouts (DSA 2004).

We have seen in this section that there are quite a few small but important differences between elements of traffic regulations around the world. In our demo version we decided to implement the most representative differences and we also concentrated on eight countries: Austria, United States of America, Australia, Croatia, Germany, Great Britain, New Zealand and Oman.

DynEST as an international driving knowledge repository

Using the computational power of today's computers it is possible to dynamically explain complex situations to the user. Dynamically Explained Symbols for Traffic is a piece of software which combines the power of information technology and the knowledge about traffic regulations of any country in the world. This enables the user to get instant information about a specific part of traffic regulations. Moreover this information is presented in a new way. Instead of using language, the information is presented in a visual way. Almost all parts of the traffic regulations are explained by the means of symbols i.e. icons.

DynEST consists of a scalable and dynamic database model which allows to manage a huge amount of country specific information. Presenting a graphical user interface users have the ability to immediately access the countries they want to compare, just by clicking on the two countries (see figure 1).

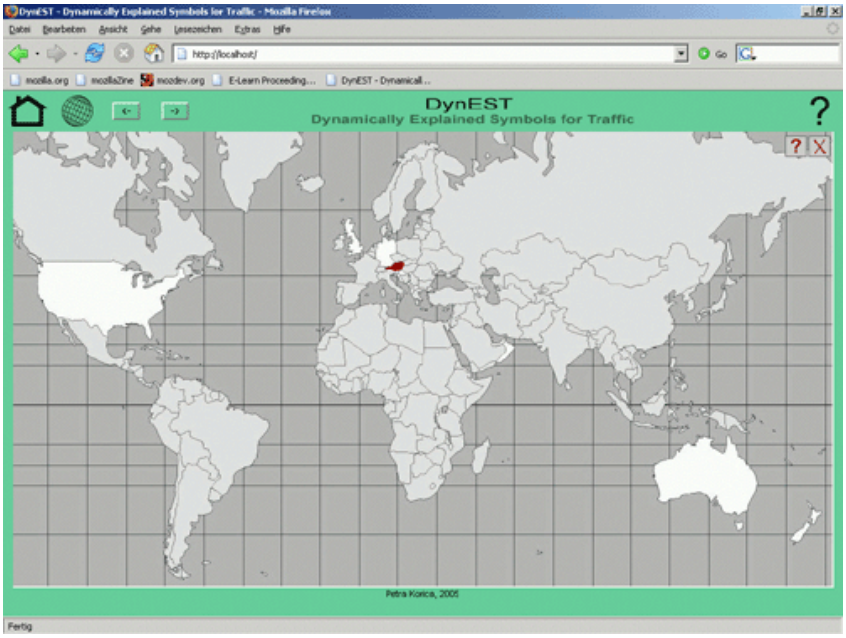

Figure 1: World map for coosing which two countries to compare. In the test version Austria is preselected.

Moreover, the flexible database model allows cross-comparing of all countries. Compared to already existing software products DynEST enables a country-independent view of traffic regulations. Thus, DynEST can be used for learning about traffic in any country.

Our solution divides traffic regulations in four big parts along the lines mentioned earlier: traffic signs, traffic rules, traffic lights and miscellaneous. After two countries have been selected the user is able to choose between these four categories. Each category gives detailed information about the differences of the countries selected before (see figure 2).

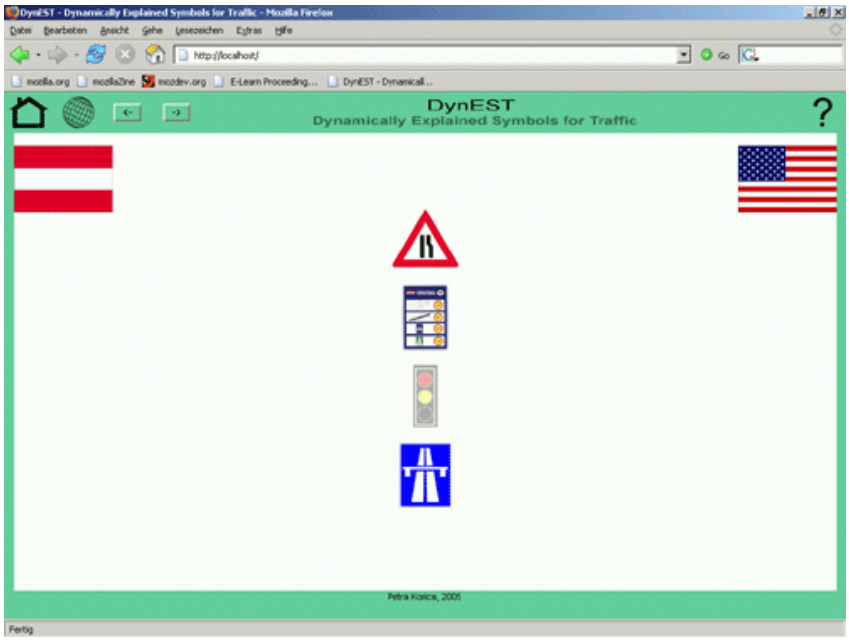

Figure 2: Comparing two countries in four categories (signs, rules, traffic lights and miscellanious).

Once the category of interest has been chosen various differences in this category will be explained using images and/or animations. As you have probably noticed, books about driving include a large number of images since there are many situations which are difficult or impossible to explain without the need for a picture. In DynEST we use images and animations to make traffic situations easier to understand. When comparing two countries there is a specific animation for each selected country and one can notice the difference between them (see figure 3).

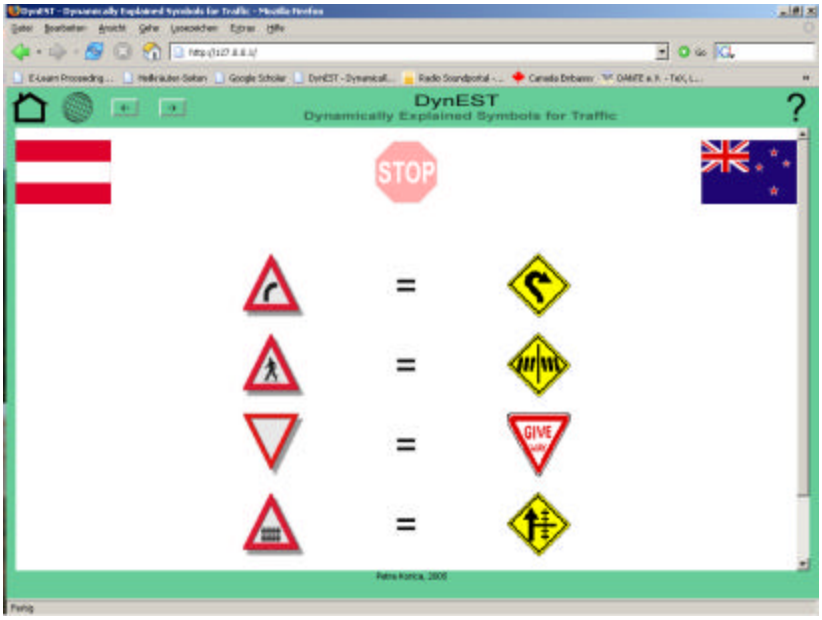

Figure 3: Traffic signs in Austria and Australia with explanation of the differences between them. = means the signs are equivalent to each other.

We tested the usability of DynEST with several users. In our tests we observed how users came along with the software. After a short period of time during the first usage all users were able to understand the meaning of images and animations used in the software. Most of them also enjoyed the "fun factor" of DynEST i.e. learning how to drive with the use of animations and images, which is far more interesting to do than just learning out of a text book.

Conclusion

In this paper we discuss how traffic regulations differ from country to country, and the consequences of this fact. We propose a solution towards an international driving license software which uses dynamic symbols i.e. animations instead of words. We believe that our experiments show that this kind of software solution is indeed possible, even if we will need to use a few words if we really want to use DynEST for all traffic regulations of all countries.

Note that there is a potentially also interesting yet different application to our symbolic approach to teaching about traffic regulations: the system could be extended to include a temporal factor. To be more specific, suppose we have obtained our driving license in 1990: it may well be of interest to see what has changed between when we took the test and the year 2005!

We have learnt from this project that it is a certainly a very major undertaking to go through all traffic regulations in many countries and to pick differences. Thus, the acquisition of data for DynEST is the real bottleneck, not the software that could easily handle all countries of the world. Hence it is more realistic to continue our undertaking with a restricted set of countries. We hope that the EU may be a potential candidate and realize the dream of Europe-wide software dealing with the traffic regulations of the currently 25 countries involved, as a first step towards a European Driving License, or to at least improving traffic safety.

References

Australia (2005) http://www.rta.nsw.gov.au/licensing/downloads/ruh_english.pdf (22.04.2005)

Bartolomeo (2005) http://www.elve.net/rcoulst.htm (22.04.2005)

Bliss, Ch. K. (1984): *The Blissymbols Picture Book*. Semantography Press, Sidney. See also http://home.istar.ca/~bci

China (2005) http://www.dlutc.gov.cn/word/sign/2.htm (23.04.2005)

DSA (2004) Driving Standards Agency for the Departement for Transport. *The highway code*. The Stationery Office, Norwich

Jonassen, D. H., & Segal-Goldman, R., & Maurer, H. (1996). DynamIcons as dynamic graphic interfaces: interpreting the meaning of a visual representation. *Intelligent Tutoring Media*, 6 (3/4), 149-158.

JUCS (2003) http://www.jucs.org/jucs_9_4 (23.04.2005)

Maurer, H., & Stubenrauch, S., & Camhy D. G. (2003). Foundations of MIRACLE: Multimedia Information Repository, A Computer-supported Language Effort. *Journal of Universal Computer Science*, 9 (4), 309-348.

Neurath, O. (1936). *International Picture Languages*. London. Reprinted by: University of Reading, Department of Typography and Graphic Communication, Reading, UK (1980)

Rideshare (2005) http://rideshare.511.org/carpool_lanes/ (22.04.2005)

Traffic (2005) http://homepages.cwi.nl/~dik/english/traffic/ (23.04.2005)

USA (2005) http://www.trafficsign.us/ (22.04.2005)

WS (2005) http://users.pandora.be/worldstandards/driving%20on%20the%20left.htm (22.04.2005)