

# HOW TO MAKE TACTILE MAPS DISCRIMINABLE FOR TOUCH?

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### The map as picture

The map image is an abstraction of a specific area, made using symbols which are based on conventions, but symbols which can vary from one map to another. With the aid of a map one can obtain a topographical overview, but one can also get from one point to another. On a map one can illustrate political boundaries, both past and present. With the aid of the map one can dream oneself away to new places or back to places one has already visited.

Tactile maps for persons with vision impairment have been produced for hundreds of years, and some are extant which date from as early as the beginning of the 19th century. The oldest surviving map of all once belonged to the blind composer and singer Teresa Maria von Paradis.<sup>1</sup> It was made to give her an overview of Europe and of the countries she visited on her concert tours. The map is an important medium for gaining an overall picture of a larger or smaller area, but in order to convey a general picture of a specific area, the map has to be adapted to the intended reader. In the case of a visually handicapped reader, the map has to be adapted for tactile perception, otherwise, in terms of clarity, it will be counter-productive.

Everyone agrees that a tactile map should be clear and that clarity in this context means tactile legibility. But the problem is how to achieve maps which an average map reader can interpret by tactile means. Being able to distinguish the different details is not enough. One should also have a chance of interpreting them as meaningful units which in turn confer an understanding of the whole. In order for such understanding to be conceivable, the reader must have learned the criteria on which a cartographic image is based and the system of symbols employed – that is to say, map notations in general and specific to each individual map. There is an advanced pedagogic of map reading, the foundations of which were already laid in the second half of the 19th century. This teaching is based on the pupil starting with a map image of his (or her) own school desk, and going on from there to a map of the classroom, the playground and the school's immediate surroundings. Then, and only then, the pupils are given an image of their town or village, followed by the region, the country and the continents, In this way the pupils' view is broadened from their immediate surroundings to an overview of the world through the map of the world.<sup>2</sup> It is only through the map that a person with vision impairment has any chance of gaining a topographical overview even of very limited areas. And so the map is an important aid to orientation in both familiar and new surroundings.

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<sup>1</sup> Eriksson, Yvonne, *Tactile pictures. Pictorial representations for the blind 1784-1940*, Acta Gotheborgensis, Göteborg 1998.

<sup>2</sup> Ibid.

In order for a person to find their way on a tactile map, the different symbols have to be clearly apparent. It is very hard to say exactly what is a clear symbol, line or surface. The answer depends on the technique employed and on the relations, within the cartographic image, between symbols, lines and surfaces.<sup>3</sup>

The points of orientation on a map can vary according to the type of map concerned. Generally degrees of latitude and longitude are used on maps showing continents or countries. But big cities, lakes and rivers also make excellent navigation points, as do clear markings on borderlines on national frontiers.

Before making a tactile map one should find out, first and foremost, what the map is going to be used for, but also which people make up the target group. The map on which to base the tactile map is then chosen according to field of application and target group. It is extremely rare for a tactile map to be produced without taking a pre-existing map as one's starting point.

## **From visual to tactile map**

### **Characterising the shape**

It is hard to define in a few words what is meant by producing pictures and maps in relief for tactile reading. And by the same token, giving instructions for the production of tactile maps is a dodge undertaking, the reason being that there are so many different factors which have to be taken into account when producing a map for tactile reading. The commonest procedure is to simplify a pre-existing map. The original to be chosen will depend on what kind of map you want to produce. An over-simplified edition can put difficulties in the way of tactile production, especially if important information to support tactile reading is missing. The west coast of Norway, for example, with all its bays and islets, comes out very "knobbly" in a detailed map. Working from a simplified map, in which the coastline too has been simplified, it is hard to tell which coastal inlets are conspicuous and therefore should be emphasised in the tactile map so that the reader will be able to identify Norway more easily.

Simplifying a shape means emphasising characteristic features at the expense of others. In the production of tactile maps this means emphasising the distinctive features resulting, for example, from a country's borders, but the important thing is to heighten the country's shape without distorting it. People must be able to find their bearings on the map without needing legends all over it, but with the support of a verbal description which may refer to recognisable details of the map image. Consider, for example, Italy, the shape of which everyone recognises as a boot. If the coastal inlets resembling creases are retained on the front of the boot leg, both Naples and Corsica will be hard to find.

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<sup>3</sup> Eriksson, Yvonne and Strucel, Monica, *A Guidebook for production of tactile graphics on swellpaper*, TPB, Enskede 1995.

## **The map format**

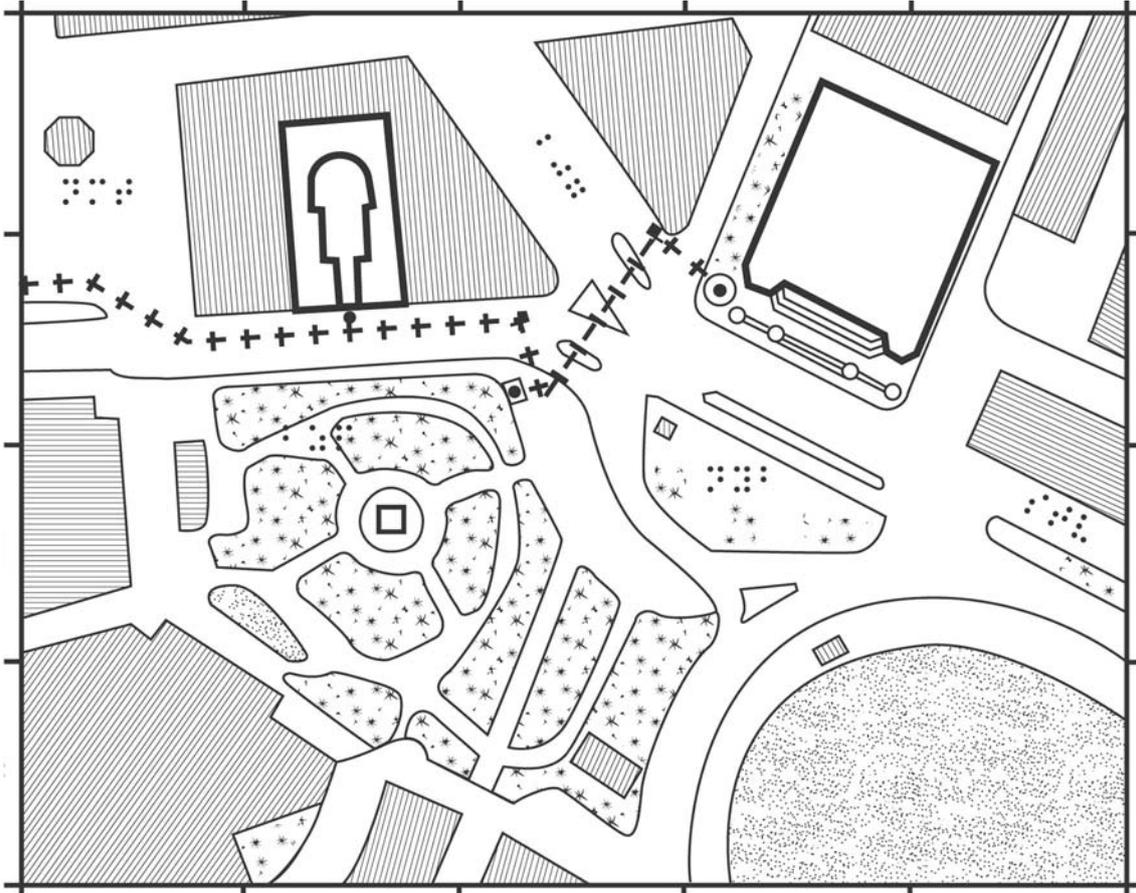
The format of the map will depend on readability format, available flex-paper format (A4; A3 and F44 are standard formats) and heat treatment hardware. Several factors help to decide the format used. If the map is for a Braille book, A4B4 may be suitable, agreeing as it does with the measurements of the Braille book. If a separate book of maps/atlas or collection of maps is being produced, A3 can also be used throughout (there are files in A3 format, so the maps do not have to be folded).

The map format has to be partly adapted to the map image: a long and narrow country like Sweden requires a portrait format, while Poland comes out best with horizontal format. The format size in turn will depend on how detailed the map is going to be. If a big format is chosen for a map of a country, then usually details like towns and cities, lakes, rivers, roads and so on can also be included. But in order for the reader to get an overall grasp of the country, you have to start with a map image that shows just the shape of the country, without any details. One has to remember, though, that shapes and lines must always be adapted to the need for finger space.

The examples that now follows are intended to elucidate our argument on simplification by emphasising the characteristics of a shape, and how this relates to the map format.

## **The map of Sweden**

Sweden is a relatively large country, at least lengthways, and a clear cartographic image of it is hard to produce in less than A3 format. Even then, all that can be supplied is an overview of the country's biggest lakes, rivers and towns. To show additional details, you have to enlarge certain areas and present them separately. These partial enlargements can consist either of individual provinces shown separately on a uniform scale, or else you can divide the country into various parts – Northern, Central and Southern Sweden, for instance. If the country needs to be divided into sub-provincial units, it may be advisable to employ a system of co-ordinates of the kind often occurring in road atlases. Each square is then given an alphanumeric designation, referring to letters and numbers shown at the top edge of the map and down one side. Now a tactile map demands a number of shifts and simplifications, and so the scale will never be exactly as given. If the map is provided with search squares, alphanumerically designated, the side of the square can be calculated and given as an approximate measurement. When enlarging an area on the map, you identify the enlarged portion by quoting the appropriate combination or combinations of letters and numbers. The grid indicates distance, and when part of the map is enlarged the size of the squares remains constant.



A detail of the map of Stockholm from *Getting in Touch with Stockholm*.  
*A guidebook for visual impaired people.*

Whatever the method used for showing a continent, country or region in several parts, one must stick to it. The transition from one part to another must be clear enough for the map as a whole to be manageable by the user.

Every time a visual map comes to be transferred to a tactile one, a new problem arises to which there is no ready-made solution. The purpose of the examples given below is to present a step-by-step method of tackling the problems. Every production of a new tactile map involves two kinds of problem which require consideration. One type is associated with the production process, the other with the recipient's specific readability requirements. To give the user maps which can be interpreted by tactile means, the manufacturer must start with cartographic material which has an appropriate scale and contains details which will supply enough information for an appropriate simplification to be possible. Not uncommonly, several originals have to be used for one and the same tactile map image, so as to include all the necessary information.

### **Getting down to details**

If you are showing just one country, detached from its neighbours, positioning by longitude and latitude is important. A quick look at an atlas will show that latitude and longitude are not always shown. If you look at our fairly simplified map of Sweden, you will see that Sweden extends over about 20 degrees of longitude. And you can also see

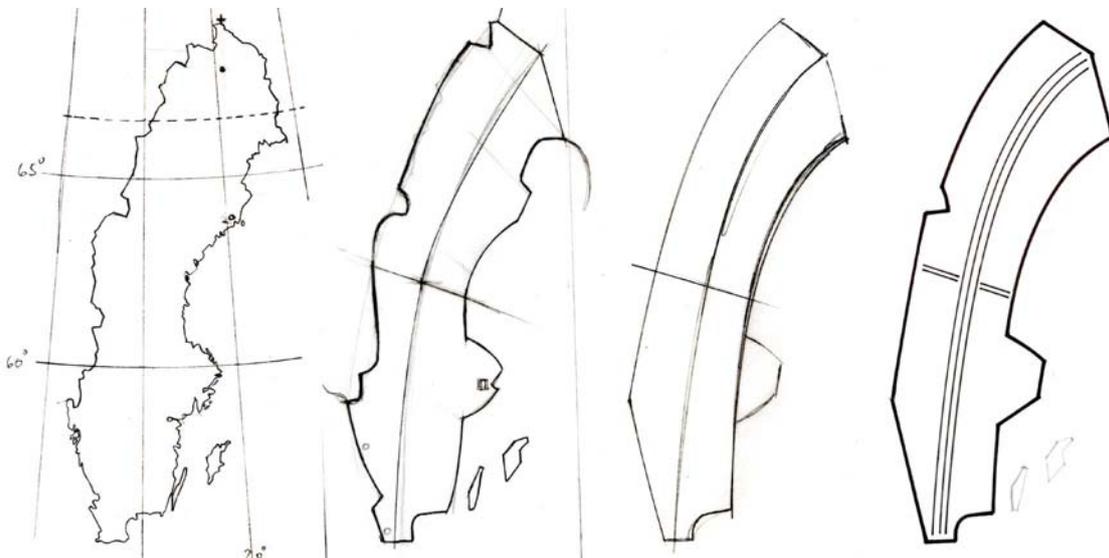
how it arches from about the 12th degree of longitude in the south to about the 24th in the north. This arc has to be discernible in the finished relief map as well.

### General map

The bigger your map, the more difficult simplification can be. The details are clear and seem indispensable. A small map image may be an easier starting point.

Tactile reading is made more difficult if, for example, a borderline shows every twist and turn of the contour. Some characteristics are worth keeping, to help the readers get their bearings, but otherwise it is better to look for the overall shape.

Sweden's long coastlines, knobbly and serrated with islands and inlets, have to be drawn as distinct, continuous curves and straight lines with clear juxtapositions of different shapes. A finger tracing a line will move faster and perceive the shape more readily if the line is clear and distinct. If there are places and details which you want to bring out in the map image, individual markings are an easier way of doing so.



### Map of Sweden, showing provincial boundaries

To make all the different provinces of Sweden discernible, a tactile map should be in at least A3 format. The general map in the previous example can very well be presented in A4 format. When moving from a smaller to a larger format, there are certain details that should be adjusted. For example, you cannot retain the same degree of simplification as in a smaller-scale map. A greatly simplified boundary line becomes misleading in larger format and should therefore be elucidated with additional details. Then again, you can add more places, as well as principal lakes and so on.

The provinces have their given shapes and extents. When simplifying, one can aim for continuous lines and shapes, pointing out distinctively shaped regions like Värmland, Dalarna and Jämtland.

The right-hand contour of Dalarna leads up to the junction between Härjedalen and Medelpad, which is roughly the geographical centre of Sweden. In the south of Sweden,

where there are many small provinces, the lakes provide points of reference. The shapes are simplified, mostly into straight lines. This makes a rather angular impression, but a more distinct one than could be achieved by using soft shapes for such small areas.

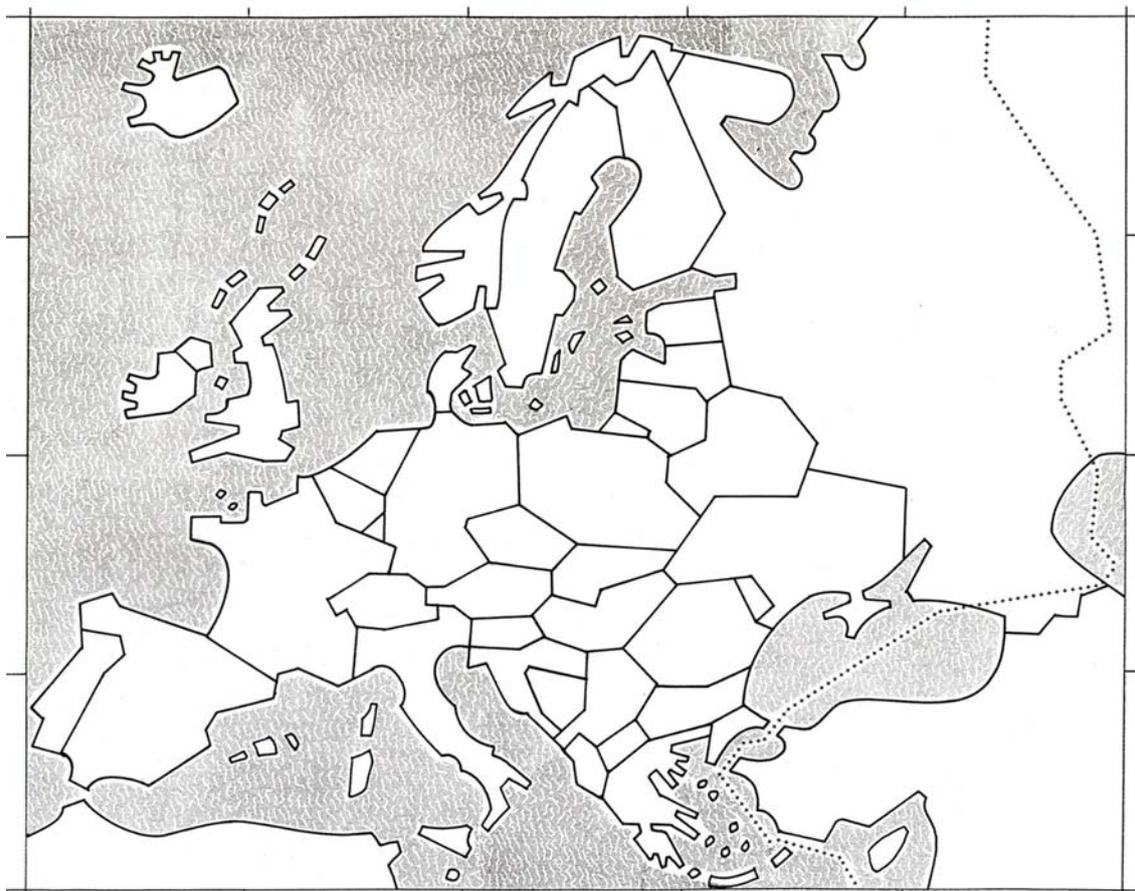
The lines are made thick and continuous, to concentrate attention on the shape. This is a “political” map, solely intended to show the extent and subdivision of the country – an overview to be kept at the back of one’s head when moving on to maps of geographic or thematic content. General maps of this kind are especially important for understanding detailed maps.



## Europe – the map of a continent

To gauge the position of a country, positioning data about latitude and longitude are not enough: more often than not, we also want to know what the surrounding countries are. An overall picture of this kind is usually conveyed by means of a continental map, and we have chosen to illustrate this by concentrating on Europe.

Europe is a compact mass of small units in which the countries have their given positions in relation to one another. Within the format at our disposal, A3, we must try to adjust the space without actually distorting relative positions.



Countries with no sea boundaries are extra hard to locate. They are numerous, they are small and they do not give us much in the way of shape or character to go by. In order for tactile reading of the different countries to be possible with such a small format as A3, certain units have to be displaced. By shifting units on the north/south and east/west axes, we do not alter the shape of countries but we do provide the additional space which the fingers need in order to interpret the map. A general map of Europe is an attempt to show the “pattern” which can make it easier to get one’s bearings – at least, sufficiently to obtain a general view of Europe.

The example below is based on a map of Europe which had already been modified. That map measures 32 x 26.5 cm and is divided into squares measuring 6.3 x 6.5 cm (4 x 5 squares). Using the full A3 format, the squares can be made 7 x 7 cm. This is not much of a change, but perhaps the space in the smallest states can be increased to make room for abbreviated names consisting of one or two Braille characters.

The change made in the actually map is a widening of the space for the Baltic and the Gulf of Finland. Denmark and Germany have been shifted downwards, so that Öresund will be detectable by touch and also to make more room for Denmark, which otherwise “merges” with Skåne.

Britain and Iceland have been moved further west so as to widen the English Channel and make room for the Channel Islands, Now that Britain has been shifted westwards, the space between Britain and Ireland has to be adjusted so as to show the correct

distance. The Adriatic also has to be widened to make it perceptible. The Adriatic has been widened, but the coast is discontinuous, as are all outlines of the countries of Central and Eastern Europe.

Once the necessary spaces have been created on the map, the different countries have to be joined together into complete shapes, which in turn has to be done without sacrificing the distinctive shape of each individual country. To make this possible, the original map (in the atlas) should be kept handy.

The thing now is to create simple shapes without losing what is characteristic of each individual country. Norway has a very indented coastline consisting of islands and fjords. This cannot be shown in a general map. Hopefully the details will be large enough to be detected even by non-experts.

Finland has been moved slightly further east, to widen the Baltic, and is shown as a simple, whole shape. Russia has been moved together with Europe, with the result that the White Sea (Arctic Ocean) is slightly bigger than it ought to be on a map this scale; but this is not detectable by touch.

To make the three Baltics distinguishable, an adjustment had to be made which augmented their area slightly. The shapes of the countries have been simplified, but now there is also room for Dagö and Ösel.

Denmark is difficult to show in a general map, consisting as it does of several different-sized islands which are squashed in between Sweden and the biggest island, Jutland. The space for Öresund has been widened to make the islands distinguishable. The islands themselves are inscribed in an irregular quadrilateral, the top side of which is a direction continuation of "Kullen". In this way the Kattegat acquires a clean coastline.

Germany's Baltic coast continues in a straight line through Denmark and out on the Atlantic side, ending as part of the coastal strip of Holland. The English Channel starts at the resultant corner; with more air/water between England and France it is easier to adjust the two coasts to one another and make room for the Channel Islands.

France, Spain and Portugal require little alteration, beyond straightening out a few curves. Those curves make little difference to the overall impression, but on the other hand it is important to emphasise Gibraltar and bring out the straits.

In order for a map to be readable to the touch in spite of its abundant detail, like this map of Europe, certain parts have to be separated and reconciled. When adjusting national frontiers in this way, it is important to create a pattern which will help the reader to identify each of the countries concerned.

## **Summary**

When producing a tactile map or picture, it is important to amplify and emphasise the characteristic features of what is being depicted. This applies no matter whether one is

making a tactile map of the world, a provincial map or a layout plan. Simplification to facilitate tactile reading must not mean trivialising the content.

It is almost impossible to indicate the widths, symbols and surface patterns to be used in tactile map production. On the other hand one can indicate relations, for example, between lines, such as distinguishing between two lines of the same kind (continuous, dotted or broken) by making one of them twice as thick. The thickness of the lines will depend on the degree of enlargement and on how many other details the map contains. Another important point is not to include too many details in one and the same map.

The symbols used in the form of lines dots and surfaces must be carefully executed and must work well together. For example, stout lines should not be combined with thin dots in a map, because the latter will then be hard to understand or even to find on the picture surface. And the design of the tactile mapping image must also be planned in such a way that the essentials will stand out clearly and less important details will appear in the “background”.