

How to make tactile pictures understandable to the blind reader

PhD. Yvonne Eriksson, The Swedish Library of Talking Books and Braille

Abstract

Most pictures can be transferred to tactile images, and in a tactile image practically anything can be illustrated. A tactile image is an image scanned with the fingertips; it is executed in relief. A relief can assume many different forms and can be produced by several different techniques. But simply producing images in relief is not enough: for tactile interpretation, they have to have a plain and simple form. Usually a tactile image is a transfer of a visual one. Often the pictures concerned are from school text books, but there are also relief images transferred from storybooks, as pictures and architecture, both plans and facade drawings. But the map is the most commonly occurring relief image. A picture is inevitably changed by being transferred to a relief image. To be intelligible by tactile means, it has to be distinct and its form logically simplified. It has to be produced in such a way that every component of its form is distinct and easily identifiable.

How to make tactile pictures understandable to the blind reader

PhD. Yvonne Eriksson, The Swedish Library of Talking Books and Braille

From object to tactile image

Perception by touch means feeling the shape, surface and size of an object. All this assuming, of course, that you can touch the object and that it is not too big to be comprehended by touch. Perception of shape, surface and size is not the same thing as being able to tell what objects represent. This applied regardless of whether you are looking at an object or touching it. In order to be able to identify something, you must have had previous experience of the object itself or something like it. It is more difficult to interpret a picture of something of which you have no experience, whether that picture be a photograph, a drawing, a painting or a tactile image - that is to say, a relief image. Interpreting a depiction may be difficult, but it can also be simple and obvious (Eriksson, 1998).

Two-dimensional representation - that is, pictures of three-dimensional objects - can be very hard to understand for someone who has severe vision impairment and is entirely dependent on their sense of touch. Very often it is also difficult for normally sighted people to comprehend and interpret pictures. One object is distinguished from another by shape, size, material and colour. Shape, though, is the main characteristic of an object. We can tell a ball from a cube because they are different shapes: material and colour are of secondary importance.

In order for a child with vision impairment to have a chance of discovering and learning to distinguish between different objects in its surroundings, help is needed in exploring them. Children will not necessarily deduce for themselves how to investigate and register important details of the things they encounter in their everyday lives.

Children are often bad at investigating objects and pictures: instead of "scanning" a picture with the tips of their fingers, they tend to use the whole hand, patting the object or picture instead. Children with vision impairment also likely to find out what sounds they can make with objects that are put in their hands. But sound tells us nothing about what the object looks like - that is to say, its shape. And so the child has to be guided through the objects or the images. A knowledge of shape can be inculcated by taking a child's hands and guiding his or her fingertips over the object or image.

The shape of the object is found by looking at its outlines. It is these very outlines which then form the contour line of the depiction, and so it is important to help the child to find the contour - that is, the outward shape of an object. Even round objects often have a straight external line, then of course there are exceptions: a ball for example, has a circular contour. Looking at a bottle, glass or a mug, on the other hand, we find that they have straight vertical lines (Eriksson, 1997a).

Transferring pictures to relief for tactile scanning demands a knowledge of tactile perception but also a knowledge of simplified representation. To be able to execute pictures that are suited for tactile scanning, we have to analyse what is to be shown and how. The procedure for this analysis will depend to a great extent on the type of image to be transferred (Eriksson, Strucel, 1994).

Tactile images

It is the technique that distinguishes a relief image for tactile scanning from other pictures. This goes for other types of pictures as well. There is a big difference between an oil painting and a photograph, or an

engraving and a watercolour. Very often the technique decides the formation of the picture. Both the visual and the tactile image are made up of lines, surfaces and dots.

Most pictures can be transferred to tactile images, and in a tactile image practically anything can be illustrated. A tactile image is an image scanned with the fingertips; it is executed in relief. A relief can assume many different forms and can be produced by several different techniques. But simply producing images in a relief is not enough: for tactile interpretation, they have to have a plain and simple form. Vision is enormously efficient; there is no getting away from that. But this is not to say that touch cannot be used, if not just as efficiently then at least more consciously. By using what is specific to tactile perception, we can produce relief images and maps of very high quality. Capacity for distinguishing different types of texture differs considerably, according to whether scanning is visual or tactile. The eye can distinguish innumerable patterns in one and the same picture, while the finger can only perceive the difference between a few textures. A relief image containing several different textures can be very hard to interpret. This means that we have just a limited number of symbols that can be used in tactile images. So it is not surprising that the long and vigorous debate on devising a uniform system of symbols for tactile maps in Europe has ebbed out. Every now and again new efforts are made to co-ordinate the use of symbols. The computerisation of map and image production has led to several initiatives with a view to devising common banks of symbols. Tying down the few distinguishable tactile symbols we have at our disposal for relief images to a particular meaning is not fruitful. If symbol banks were used, the symbols would not be tied to a particular field of application. In contrast to previous attempts, clear symbols are now to be devised for use in various connections.

Usually a tactile image is a transfer of a visual one. Often the pictures concerned are from school text books, but there are also relief images transferred from storybooks, art pictures and architecture, both plans and facade drawings. But the map is the most commonly occurring relief image. A picture is inevitably changed by being transferred to a relief image. To be intelligible by tactile means, it has to be distinct and its form logically simplified. It has to be produced in such a way that every component of its form is distinct and easily identifiable. It is also commonly said that the image should not contain overlaps and perspectives depiction or incomplete objects. There are both very simple relief images and more complicated ones. A beginner, even if he or she is a person of mature years, needs to start with the very simplest images (Eriksson, 1997 b).

Relief images occur in various connections and are made using various techniques. The technique to be used will depend on the field of application, the user category and the resources available in terms of both money and skills. Whatever the technique, tactile images have to be produced with special allowance for tactile perception. A number of handbooks on production of relief images have been published in recent years, dealing both with the technique itself and with the formation of relief images (Edmann, 1992; Eriksson, Strucel 1994; Levi, Rolli, 1994; Hinton 1996).

Thermoform - the importance of the matrix for different textures

Thermoform is a technique of moulding plastic in a matrix, using a vacuum press at high temperature. It is the matrix design that decides the appearance and quality of the finished relief image. The grain of plastic chosen can affect the readability of the finished image. A thermoform image can have several different levels of relief, and in this way one object on the surface of the image can be distinguished from another, not only by its shape and extent but also by differences in height. Most thermoform images are monochrome, but there are also images of this kind printed in polychrome, with colours matching the different textures and lines of the picture surface.

Swell paper - line, dot and surface

With swell paper, unlike thermoform, only one level of relief is possible. Lines, dots and surfaces are used to create relief images, either by drawing straight into the swell paper or by transferring a drawing to it. Swell paper is ordinary paper coated with a thermosensitive emulsion. By using a carbon-based pen or copying a picture in an ordinary copying machine onto swell paper and then exposing the swell paper with the image to infrared heat, you obtain a relief. The swell paper image is the commonest type of relief image occurring today, and these pictures are technically simple to produce. Sometimes the method might seem a little too simple. It presents many opportunities for committing fatal errors, such as that of copying a picture from a book and swelling it into a relief image without any adaptation. Despite the simplicity of the technique, then, the swell paper image has to be designed for tactile scanning.

Silk screen - line, dot and surface

Silk screen offers much the same possibilities as swell paper, but it is more durable, though on the other hand it is more complicated to produce and, in small production runs, more expensive. The relief in a silk screen image can take the form of lines, dots or surfaces. An unprinted relief can be printed onto a colour picture, which may be desirable if you have a colour picture with a great deal of contrast, which can also

be enjoyed by someone with defective vision. The relief can also be printed in one colour on a neutral background.

Colour prints on paper - the form

A more exclusive method of producing relief images is the tactile picture books published in France, which are printed on paper with the relief sections in colour. A stout paper is pressed in a metal mould consisting of what are known as a male and female part. By embossing the paper between these, you get a relief image containing lines, dots and surfaces. The surfaces are smooth but form a distinct contour against the background. Because the relief sections are in colour, these pictures are also suitable for people who are partially sighted.

Pictures of different materials

Although the child's tactile understanding of form develops at about the age of one year, learning to handle the concept often takes a great deal longer. This is true not least when children with severe vision impairment have to learn to perceive and understand tactile images. To facilitate this understanding, images are made of different materials with a tactile resemblance to the material of the object depicted. In tactile images of different materials, the material is chosen in such a way that the overall tactile impression of an object will be as similar as possible to the visual impression it makes. The important thing, though, is for the object to resemble the impression of the true object as a whole, and so it is very seldom one can use the same materials as in the real object, because the scale affects the impression made.

The different materials have to articulate the image. It is form that decides how an image is perceived. The fur of a rabbit is very hard to distinguish from that of a cat, but the big ears of a rabbit are easily distinguishable from the small ones of a cat. The important thing is for the picture of the cat and the picture of the rabbit to be soft and for the form to be distinctly apparent. If real rabbit fur is used to illustrate a rabbit, this usually gives the wrong impression, because on a small scale the rabbit fur becomes too long-haired (Eriksson, 1997 b).

In order for tactile picture books of different materials to be also suitable for the partially sighted reader, the pictures are done in highly contrasting colours: usually a dark background with bright figures standing out from it. To a person with vision impairment, a bright background with dark figures tend to form a silhouette, in which case details are lost.

Low or high relief in tactile images

Thermoform images and relief images of different materials can be made high, but there is another fact which argues against high relief. High reliefs are difficult to interpret, because an object shown in high relief does not form a distinct shape against the background. Added to which, there is then one more side to be interpreted, namely the edges of the high relief.

It's surprising, the smallness of differences in level which can be detected by touch. The distinctness of the relief image is not connected with the height of lines and surfaces. Instead it is the clarity of form that decides: complicated shapes and carelessly drawn lines make the tactile reading of an image difficult.

Vision and pictures to look at

When we look at an object - be it a real object or a painting - our knowledge of it is based on a flow of nervous activities initiated by light reflected from a surface. This light, which is purely physical in nature, reaches the retina of the eye, where it is transformed into a nervous activity, which is transmitted to the brain. Vision is completed by visual stimulus of the eye and by the interpretation of that visual stimulus in the brain. In order to see the world, the first thing we need is physical energy: without the oscillations of electromagnetic energy, there would be nothing to perceive, nothing to see, nothing to understand (Solso, 1994).

In the brain, complicated links are formed between incoming signals and a large number of nervous units, and these impart meaning to the visual objects. The basic information is obtained from the eye and is organised in the brain into meaningful patterns (Solso, 1994). It is during this stage that an immense knowledge of the world in general, and art in particular, is added to our sensory information: the object is interpreted. The same goes for the signals, which we obtain through the sense of touch. The basic requirement for being able to *see* a picture then, is light, must as relief is necessary in order for us to be able to sense an image by touch.

The human eye is by no means the most complex optical system. Generally speaking, the simpler the brain possessed by a being, the more complex its optical system will be, whereas a more complex brain often means a simpler optical system. The complex human brain requires only one, fairly simple optical system. Because the human field of vision is limited, our eyes have to be kept in motion all the time, so that we can clearly perceive entire surfaces. As a consequence of our eye movements, we are never able to see the entire picture at once. Instead we base our vision on looking at one small part at a time. This can be partly compared with the technique of scanning a tactile image with the fingertips, except that

tactile scanning has to be more systematic than the flickering of our visual gaze. Not even visual perception, then, is a static activity. We distinguish the different parts of a picture because the contour of the object depicted creates a distinct shape against the background. Contours enable us to separate the different objects from each other. A contour arises on the boundary between two surfaces. Most commonly, contours of pictures are created with lines. And it is the contours we look for so as to be able to distinguish objects in our surroundings, not least in the natural environment. Through the contours we find the shapes and in this way are able to get our bearings. In fog or in the dark we cannot find these contours, and this makes it hard for us to see where we are and find the right way if we are to rely on our vision. The ease with which we can perceive lines is due to our brain being prepared to interpret these signals. It is also the line that makes it possible for people with vision impairment to perceive objects and pictures. By tracing the contour of an object they apprehend its form, and that is the form which recurs in the tactile image (Kennedy, 1993).

The components of the image

Image or pictures is a term with many meanings. We can speak of mental pictures, dream pictures, mirror images, metaphors - also pictures of a kind - and pictures directly representing something in particular. The American art-historian W.J.T. Mitchell (1986) has constructed this scheme of the concept of images.

Images				
Graphic	Optical	Perceptual	Mental	Verbal
illustrations	mirrors	sense-dates	dreams	metaphors
design	projections	appearances	memories	descriptions
			ideas	

What I intend dealing with here is the physical image, the two-dimensional representation. The image consists of different parts, known as picture elements, which cause it to create shapes, which we interpret as pictures.

The discussion of what a tactile image means can be roughly summarised by saying that, by and large, colour and shades of light are all that distinguish the tactile image from the visual one. The tactile image contains lines, dots and surfaces that are organised on a picture surface so as to be capable of reproducing specific objects and phenomena. This means that the concepts used regarding visual pictures are also applicable to tactile images. The concepts I will be dealing with here are suggestions concerning how we can talk about pictures to people with vision impairment. The descriptions were originally devised as an introduction to a study of the perception and understanding of art pictures transferred to relief (Eriksson, 1994 b). The study showed that to the survey group several of the terms used in the introduction - horizon, for example, were just empty words.

Picture surface

The picture surface is the flat, two-dimensional surface on which the picture is presented, and this also includes images presented in relief. The picture surface is the plane on which the image is seen, both visually and by touch. It is in relation to the picture area surface that all planes; shapes and lines acquire their character. Which means that what we see and describe is always related to the picture surface. This is extra important when describing and talking about pictures to someone who cannot see them. When describing a relief image - that is to say, guiding the reader through it - one has to relate the different elements of the image to the picture surface.

Lines

The line can have many different appearances and meanings. In relief images the lines often has several appearances in one and the same picture, so that people will realise that the lines represent different things. In pictures for people who can see, it is sufficient for the lines to have different colours or thicknesses. A closed line forms a figure which can be depictive or abstract. When the line forms a figure, the interesting thing is not the line in itself but the form which it reproduces.

The line often plays an important role in reproducing spatial relations in the picture surface. We are talking here about the horizontal line, the vertical line and the diagonal. The way in which the line is perceived depends on where you yourself stand in relation to it. It has been found that the line we find it easiest to remember is the vertical line, next comes the horizontal and the most difficult of all to remember is the diagonal. The fact that the vertical line being the easiest one to remember is due to the law of gravity but also to our mainly upright posture. The study includes people with both normal vision and severe vision impairment.

In traditional picture analyses, the horizontal line has been called the line of repose. In the depiction of something outdoors, it is on the horizontal line that sky and land meet, or sky and sea. The horizon, in other words. The horizontal line can come at different levels in the picture, depending on whether the horizon is a long way away or not. If the horizontal line is high up on the picture surface, this means that the horizon is far away. In interior scenes, the horizontal line - that is, the boundary between floor and wall - is generally very far down on the picture surface, because usually the distance in the room is limited.

In relief images the horizontal line is usually the line on which the people, animals and so on depicted are positioned. A horizontal line representing the horizon is very unusual in tactile images.

The vertical line runs from the top downwards or from the bottom upwards, depending on what you want to show with it. Together with the diagonal it makes up the activity of the picture. The reason for the diagonal and vertical lines being termed active lines is that they illustrate forms of movement or change. Something rises or falls drastically on a vertical line: the apple falls from the tree or, in a diagram, you can illustrate the falling rate of interest. The diagonal line reproduces changed of a less drastic kind: the car climbing the hill or the trend illustrated in a graph line for slowly rising unemployment.

Pictures also contain what you might call invisible lines, meaning that the picture is composed in such a way that objects are positioned on a diagonal, vertical or horizontal line. This can also be a matter of directions, for example with a group of people aligning themselves diagonally across the picture surface, either with their whole bodies or through the direction in which they are looking.

The line is an important pictorial element because it is used in practically all visual display, and with the aid of lines, most things can be transferred to tactile images. But the line has one function which can make it troublesome: it has two sides. For example, if on a map of a large area - say a province or a county, you have lines indicating the county boundary, rivers, roads and railways, then new shapes are formed between these lines. Shapes which can prevent the experience of wholeness - the shape of the county in this particular example.

The nature of surfaces - texture

Texture is the nature of a surface as perceived by touch, and texture often has an important effect on visual experience as well, the reason being that our visual experiences are often united with our tactile ones. Many people speak of structure when what they really mean is texture. The structure of a surface is the order which a pattern forms on it, and this has nothing to do with the nature - the texture - of the surface.

In relief images, different textures are used so as to make the different picture elements more easy to distinguish from each other. In relief picture books intended for very young children and beginners, the objects are generally made of different materials. These materials are chosen so that the texture will resemble the actual material of the thing depicted, but at the same time make it easier and more enjoyable to sense the pictures by touch.

Plane

A plane is a combination of lines and surfaces to create a dimension of depth in the picture. This depth dimension can only be perceived visually, even though, to some extent, it can be apprehended by touch. Imagine a horizontal line two-thirds of the way up the picture surface and two lines which are really parallel and run diagonally from one corner of the paper to a point on the horizon. If two figures, similar in appearance but different sizes, are positioned along the line, the smaller one further up on the picture surface and the larger one further down, a person looking at the picture will perceive the smaller figure as being further away than the larger one. This impression of the figures being the same size but different distances away is due to our having that experience from looking at our surroundings.

In tactile perception, the effect will not be the same. There can only be intellectual knowledge or experience of something looking smaller when it is far away from the beholder. It is the relation between the beholder and the beheld which decides how we experience the relation between size and distance. Just as a noise fades when you move away from it and it gets louder and when you move towards it. The beholder who has severe vision impairment and has to study a picture with his fingers is all the time at one and the same distance from the different elements of the picture. Even if something is shown as being a long way on the horizon, the beholder, with his fingertips, is on the spot and not at a distance from it, unlike the person who can see the picture. The illusion is broken.

Volume

Volume is the same as size and circumference. In a picture, the illusion of volume can be conveyed by means of line and colours, light and shade. Volume cannot be reproduced the same way in a tactile image as in a visual one. But the finger can be tricked into perceiving several levels in a swell paper image by combining different lines and surface patterns. In the thermoform image, reliefs can be made on several levels and volume in this way reproduced. By using different materials for relief images, we can also

reproduce something of the volume of a picture. Material with a certain elasticity can convey the sense of volume.

Colour

Although colour is a purely visual phenomenon, it is not unimportant to talk about colours to people with severe vision impairment. It may be interesting to know that organisations have logotypes of a certain colour, which makes them easy to recognise and identify.

The meaning of the picture

There are many differences between tactile and visual perception. This must not be confused with the possibility of understanding and interpreting what is perceived. In order for correct perception and understanding to be possible through the sense of touch, one should know how to go about using that sense efficiently. Before children can relate tactile images or maps to the reality around them, they have to be trained to understand form, direction and distance. When we look at or feel pictures, this includes both what something looks like and where it is on the picture surface. But it also includes size: the concept of scale also has to be made clear. To be able to relate to spatial concepts as above, below, middle, behind, in front of and so on, we have to learn what they mean. When working with severely vision-impaired children, it is not only necessary to teach the child to understand the meaning of these concepts, one also has to be careful how one uses them. Just pointing will not do. One has to verbalise the position of an object.

In order for the meaning of a position description to be clear, one has to be distinct. I can illustrate the importance of this by describing something that happened to me. A ten-year-old boy with severe vision impairment was busy making a map of the area surrounding a lake in Sweden called Vatern. He had to mark the place where he lived, and he was uncertain where to put the mark. The boy asked his teacher where round Lake Vatern he should put the pin for the place where he lived. The teacher replied: "In the middle". The boy was very cross: "In the middle, surely I can't put the pin in the middle of the lake." "Yes you can," The teacher replied taking it for granted that the boy would understand what she meant. It took quite a long conversation for the teacher to realise that the boy had misunderstood her and taken her instruction literally (Eriksson, 1997).

Describing pictures

Being able to distinguish different raised lines, surfaces and dots on a picture surface by touch is not the same thing as being able to interpret them as representing particular objects. It is important to remember the difference between looking at a picture or feeling it. To be able to identify something by touch, one is, more often than not, in need of further information, especially of the verbal kind - a description. Usually a tactile image includes not only an object to be identified but different parts, the relationship between which is important. Being able to identify an object does not automatically mean being able to locate it. Which is to say that, even if you can recognise the picture of a crow, you do not automatically know how the crow relates to its nest, which is also shown on the surface of the picture. Here, then, we have two problems: the possibility of identifying the object or objects in the picture, and the possibility of perceiving how they are related to each other.

Picture reproduction for people with vision impairment can mean picture descriptions, relief images or models. In all three cases, some form of description is needed, either from somebody present or else as a tape-recording or in Braille. A distinction is made between a picture description and a description which guides a person through the picture or model. This latter is usually termed picture guidance. It means indicating how a person is to feel the picture or model and what he or she is expected to find in the different parts of it.

In a picture description, the content of the picture is presented in print or speech. This not to be confused with giving one's own experiences of the picture. Picture description vary, depending on the type of picture involved.

Picture description

Because the picture is multi-dimensional and can contain many details, describing it is not always very easy. Describing a picture means translating from one medium to another, from image to text. All translations involve a problem of interpretation, in the sense of having to judge what is the best word for an object or phenomenon. This is a matter of defining objects and concepts. And so, inevitably, the description of a picture is always arbitrary and subjective to some extent. At the same time we must not forget that often the fascinating thing about pictures is that they are open to several interpretations, without any of those interpretations necessarily being wrong.

The best plan is usually to divide a picture description into four stages:

1. Present the picture and give a general view of it before going into detail.
2. Locate each element of the picture first before starting to describe it. This means explaining where the object depicted is to be found on the picture surface.

3. Describe the picture in detail, once it has been presented and the different parts located. The information given should be extensive enough to give the pupil a notion of the appearance and/or function of the different parts.
4. Make a summary of the picture. Ending up with a short summary is a good way of returning to consider the picture as a whole.

Picture representation means saying that this is a picture of a horse, an electric motor, a map of Europe or a figure representing a cube. One also explains where the picture is, in the text book, that it is shown as a slide or as a poster. Sometimes it may be interesting to know how large the picture is, in which case you give the measurements. If the description is addressed to younger children, they have to be given some references in order to understand what the unit of measurement implies.

Picture guidance

It is virtually impossible for a person with severe vision impairment to understand what a relief image contains and how it is constructed, without a presentation or some form of descriptive text. This applies above all when showing pictures to children and to people whom are unfamiliar with relief images. Most relief images contain some form of presentation, either in the form of a picture title or indirectly in the accompanying text. Detailed guidance is needed in order for a child feeling a relief image for the first time to be able to understand it.

Just as when describing a picture, it may be appropriate to divide the picture guidance into several stages: presentation of the relief image, general guidance so that the person who is to touch the picture will gain a general idea of it, before going into details.

Conclusion

Looking at pictures and interpreting their content is a painstaking task, especially if it has to be done entirely by touch. With relief images representing different objects and phenomena with which the reader is familiar, and with a thorough introduction to the image or map, most people have chance of not only distinguishing, identifying and locating the different parts of the picture but also of experiencing the joy of being able to receive the story which the picture has to tell.

Reference

- Edman, P. (1992). *Tactile Graphics*. New York: American Foundation for the Blind.
- Eriksson, Y. (1998). *Tactile pictures. Pictorial representations for the blind 1784-1940*. Goteborg: Acta Universitatis Gothoburgensis, Art and Architectural Studies 4.
- Eriksson, Y. (1997a). *Fran föremål till taktil bild*. Solna: SIH Laromedel.
- Eriksson, Y. (1997b). *Att känna bilder*. Solna: SIH Laromedel.
- Eriksson, Y. & Strucel, M. (1994a). *A Guidebook for production of tactile graphics on swellpaper*. Enskede: Talboks- och punktskriftsbiblioteket.
- Eriksson, Y. (1994b). *Konsthistoria för synskadade*. Enskede: Talboks- och punktskriftsbiblioteket.
- Hinton, R. (1996). *Tactile graphics in Education*. Edinburgh: Moray House Publications.
- Kennedy, J.M. (1993). *Drawing & the Blind. Pictures to touch*. New Haven: Yale University Press.
- Levi, F., Rolli, R. (1994). *Disegnare per le mani. Manual of Tactile Graphics*. Torino: Silvio Zamorani Editore.
- Mitchell, W.J.T. (1986). *Iconology. Image, Text, Ideology*. London: The University of Chicago Press.
- Solso, R.L. (1994). *Cognition and the Visual Arts*. Cambridge, Massachusetts: The MIT Press.
- [Go to the top of this page.](#) | [Go to the upper category.](#)

Information Center 日本社会福祉学協会 障害者福祉学研究会 (JSRPD)
22-1, Ichome, Toyama Shinjuku-ku Tokyo 162-0052 JAPAN

[Contact us](#)

Copyright (c) 2007-2010 Japanese Society for Rehabilitation of Persons with Disabilities (JSRPD) All Rights Reserved.