

# Image Content Origins of Wayfinding Pictograms from the 1960s and 1970s

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Wayfinding pictograms are sometimes seen as “words” of a “visual language.” This research investigates for 52 common referents in which organizations and domains these words originated. This research is on the pioneer period of wayfinding pictogram development, 1963–1974, using a set of 24 pictogram systems. The results shows that the image contents of most common pictograms that we use today were introduced in only three years’ time by transport organizations. Olympic events and world exhibitions played a minor role in this process. Known designers probably focused more on improving the visual perception and consistency of a pictogram set. A comparison of image contents of pictogram systems from 1963–1974 with two more recent systems suggests there has hardly been any evolution in contents since.

## *K e y w o r d s*

*pictograms,  
1960s,  
evolution,  
wayfinding,  
image contents*

# Where Do the Image Contents in Wayfinding Pictograms Originate?

## The Olympic Games as milestones in the history of wayfinding pictograms

The 1960s and early 1970s are seen as a pioneer period in the development of wayfinding pictograms for public space. During this time, several well-known pictogram systems for Olympic Games and world expositions were introduced. Design historical overviews emphasize the importance of these systems as an example for pictograms in general. For example, Meggs and Purvis (2011) noted that the pictograms of the Tokyo Olympics—introduced in 1964 and art directed by Masaru Katsumie—served as “a guide for universal public visual design systems and worldwide events” (p. 429). Similar remarks have been made about the system that Otl Aicher and his team designed for the 1972 Munich Olympics (Eskilson, 2007, p. 321). Design history also associates the development of pictograms with the development of a visual language, in which famous designers play a crucial role (Katsumie, 1971, p. 369). An interesting implication of bringing up the term “language” is that it suggests that these designers—and by extension, Olympic Games and world exhibitions—gave us the “words” of this language, the image contents of pictograms. But is this really true? There are reasons to doubt this.

## What about pictogram standards of transport organizations?

Not much attention has been given to the parallel introduction of pictogram systems by transport and tourism organizations in the 1960s (Bakker, 2013). These systems were developed by lesser-known designers and amateur draughtsmen, aided by officials, and were often laid down in standards that found long-term use. The first of these organizations to introduce a pictogram standard was the Union Internationale des Chemins de fer (UIC), also known as the International Union of Railways, in 1963. The UIC was the leading international railway organization in the Western world, and it developed railway standards and policies. Its members were mainly national railway companies that owned both transport means and stations. They were obliged to follow the UIC standard if they wished to introduce a pictogram system. Similar systems were introduced by aviation organizations. Their longevity and general use make it likely that these more anonymous

pictogram systems exercised a larger influence over our current pictogram systems than is generally assumed in design history, especially in regard to image contents. After all, the pictograms developed for Olympic Games and world exhibitions were typically disposed of after these events were finished.

## Aim of this research

This research sets out to study the introduction and evolution of image contents for the most common referents used in wayfinding pictogram systems. It aims to establish which organizations and domains—such as railways, events, aviation, or tourism—introduced these image contents, and whether these contents evolved after their introduction. Establishing this is a first step toward developing a less “designer”-oriented history of wayfinding pictograms—one that also acknowledges the role of institutions in shaping our designed environment. The introduction and evolution of image contents was researched for 24 representative pictograms systems from the period between 1963 and 1974, for 52 well-known referents. In order to do this, a new approach was developed that aimed to quantify the contribution of different domains and organizations. To verify certain aspects of this approach, two systems from 2017 were also researched. This follow-up research was also used to check whether image contents for earlier researched referents had undergone major changes since the 1970s.

## Pictogram, image content, and referent

Pictograms are abstracted graphic pictorials, and are often part of a set, system, or a collection of pictograms that is designed for a specific client or purpose. They are used to indicate certain functions or desired behaviors—for example, when using products or for wayfinding. A good example of pictograms are the abstracted depictions of a male or a female to indicate toilets and their intended users. Pictograms in a set usually share a common visual style or aesthetic, which helps in identifying them as part of a specific system, and assert certain emotional or associative qualities. In this article, pictorial and non-pictorial graphic elements are referred to as the image contents of pictograms, whereas the referent of a pictogram stands for the concept or thing that the image contents refer to. For example, the “telephone” pictogram refers to the presence of a telephone, the referent, whereas the image contents of this pictogram typically consist of a telephone horn (Figure 1) (ISO/TC 145/SC 1, 2007). It should be noted that this research only looks at wayfinding pictograms for pedestrians and leaves out traffic symbols and road signs due to their specific nature and history.

Figure 1

**Pictogram: telephone**

The image or sign itself in all its graphical detail

**Referent: telephone**

The object or concept that the pictogram refers too



**Image contents: telephone horn**

The general contents of a pictogram, as it can be described in text



Figure 2

| Abbr. | Organisation                              | Year   | Country         | Design  |
|-------|---|--------|-----------------|---|
| ADCA  | Australian Department of Civil Aviation   | 1972   | United Kingdom  | Kinneir, Calvert and Associates   |
| ADV   | German Airports Association               | 1968   | Germany         | M. Krampen and H.W. Kapitzki  |
| ATA   | Air Transport Association                 | 1966   | United States   | Arnold Thompson Associates  |
| BAA   | British Airports Authority                | 1972   | United Kingdom  | Kinneir, Calvert and Tuhill   |
| D/FW  | Dallas-Fort Worth International Airport   | 1973   | United States   | Henry Dreyfuss Associates   |
| FA    | Frankfurt Airport                         | 1971 * | Germany         | Otl Aicher and staff  |
| ICAO  | International Civil Aviation Organization | 1970   | International   | -   |
| IATA  | International Air Transport Association   | 1966   | International   | IATA  |
| LVA   | Las Vegas Airport                         | 1972   | United States   | Richard Graef and John Follis   |
| NPS   | National Park Service                     | 1970   | United States   | Chermayeff and Geismar Associates   |
| NRR   | Netherlands Railroads                     | 1968 * | The Netherlands | Gert Dumbar of Tel Design Associates *  |
| O64   | Olympic Games (Tokyo)                     | 1964   | Japan           | Masaru Katsumie (directed by)   |
| O68   | Olympic Games (Mexico City)               | 1968   | Mexico          | Lance Wyman and Beatrice Cole   |
| O72   | Summer Olympic Games (Munich)             | 1972   | Germany         | Otl Aicher and staff  |
| Pg    | Picto'grafics                             | 1972   | Canada          | Paul Arthur and Associates  |
| Port  | Port Authority of New York and New Jersey | 1971   | United States   | Owen Scott  |
| S/TA  | Seattle-Tacoma Airport                    | 1971   | United States   | Donald J. Gerands and Richardson Associates                                   |
| SP    | Swedish National Parks                    | 1972   | Sweden          | -   |
| TA    | Tokyo Airport                             | 1970   | Japan           | Aisaku Murakoshi  |
| TC    | Transport Canada                          | 1974   | Canada          | Ministry of Air Transportation Design Staf                                    |
| UIC   | International Railroad Union              | 1963   | International   | UIC   |
| W072  | Winter Olympic Games (Sapporo)            | 1972   | Japan           | Fukuda Shigeo   |
| X67   | Expo 67, Montreal                         | 1967   | Canada          | Paul Arthur and Associates  |
| X70   | Expo 70 (Osaka)                           | 1970   | Japan           | Eknan Kenji, GK Industrial Design Institute, Isozaki Arata, and Fukuda Shigeo |
| X     | Canadian National Signing System          | -      | Canada          | Hunter Straker Templeton Ltd.   |
|       | KFAI AB (Sweden)                          | -      | Sweden          | Claes Tottie  |
|       | Mexico City Metro                         | 1969   | Mexico          | Lance Wyman   |
|       | Olympic Games (Montreal)                  | 1976   | Canada          | Georges Huel and Pierre-Yves Pelletier  |

Rail
  Events
  Part of the DOT evaluation but not used in this research

Aviation
  Tourism

\* Date or designer added by the author

# Using Evaluated Pictogram Systems from the DOT Symbol Signs Reports as a Foundation

## The DOT Symbol Signs reports

To investigate the historic development of image contents in wayfinding pictograms, a representative selection of pictograms and referents was needed. This selection was found in the reports that accompanied the introduction of the U.S. Department of Transportation (DOT) pictograms in the 1970s (DOT, 1974, 1979). These pictograms were intended as a general and freely available pictogram set for public spaces in the United States. Over time, it has become one of the best-known sets worldwide. It was developed by the designers Raji Cook and Don Shanosky, aided by a committee from the American Institute of Graphic Artists (AIGA), headed by designer Thomas Geismar. The AIGA committee gave the designers image content recommendations based on the results of an evaluation that it had made of 28 pictograms systems, all introduced between 1963 and 1976. As part of this evaluation, the AIGA committee matched the image contents of these systems with the referents for which the DOT needed pictograms. This resulted in the collection of circa 600 categorized pictograms, which were depicted in the DOT Symbol Signs reports that described the development of the DOT pictograms. This collection is at the heart of the research presented in this article.

## How did the AIGA allocate image contents to referents?

A potential caveat in using these already-categorized pictograms was that the reports did not explain how the AIGA had allocated pictograms of the evaluated pictogram systems to the DOT referents. Was this based solely on the image contents, or were the referents (the intended meanings of the pictograms) also taken into account? Research into a sample of the collected systems suggests that a combination of referent and image contents matching was used. At the time, the typical pictogram set contained between 25 and 40 referents, with a relatively large semantic distance—a difference of meaning—between them. The same could be said for the associated image contents. Referents and image contents were tied in unique combinations. For example, the DOT referent “coffeeshop” matched with referent names such as “coffee” or “lunch room,” with associated image contents being either

a coffee cup and saucer or a mug. It was hard to confuse these with the DOT referent “restaurant,” which was also referred to as “diner” in some evaluated systems, and was associated with depictions of cutlery, often combined with a plate.

## Representativeness of the pictogram systems and referents

The systems from which the evaluated pictograms stem are to a large degree representative for the pioneer phase of pictogram development. They include all five known and introduced pictogram systems for wayfinding up until 1967 and a large sample of 23 systems for the period immediately thereafter (Figure 2). They cover the most important countries, producing such systems such as the United States, Canada, Germany, and Japan. Apart from the latter, the development of pictograms was limited mainly to North America and Europe at the time, especially in the 1960s. The samples also cover the most important domains for which wayfinding pictograms were developed during this period: railways—hereafter referred to as rail—aviation, events, and tourism. In addition, the DOT referents represent a wide and common range of applications and domains. This was a reflection of the fact that the list of needed referents was established by a DOT committee that included representatives from the United States industry and government organizations responsible for infrastructure, transport, land use, and tourism. In summary, the DOT referents and the categorized pictograms in the DOT Symbol Signs reports are well-suited to serve as a starting point for tracing the development of image contents during the pioneer phase of pictogram development.

## Adjustments made to improve representation

Nevertheless, a few adjustments were made to make system representation more balanced and useful. As a result, four systems were removed. Two of these could not be dated; one of them was the only representative for the years 1975 and 1976, and one consisted of only two symbols. In addition, the extensive pictogram system of the UIC was split into two parts, reflecting its stepped introduction and distribution in 1963 and 1965. Since it was the first pictogram system to be introduced worldwide, a correct dating was deemed particularly relevant. This resulted in a final data set of 24 selected pictogram systems, covering the period of 1963 to 1974.

## Categorization of pictogram systems into four domains

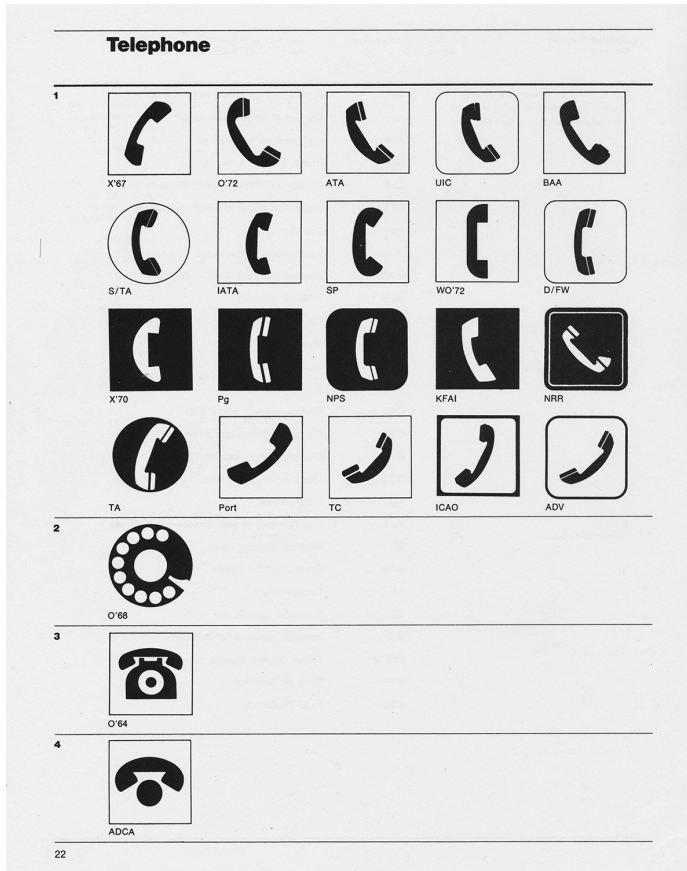
The selected systems were categorized as belonging to one of the following domains: rail, events, aviation, and tourism. Rail is represented by two systems, the main one being that of the earlier mentioned International Railway Union (IUC). Aviation is represented by 14 systems. The most important of these are the Air Transport Association of America (ATA) that represented United States airlines, and the International Aviation Transport Association (IATA), representing most Western international airlines. Both systems were introduced in 1966, and were superseded—as a standard for aviation—in 1970 by the pictogram system of the International Civil Aviation Organization (ICAO). The large number of aviation systems is a reflection of the spectacular growth of airlines and airports, and the relative lack of pictogram systems in other domains at that time. The events domain covers six systems: the Olympic Games of Tokyo (O64), Mexico City (O68), Munich (O72), and Sapporo (WO72), and the world expositions in Montreal (X67) and Osaka (X70). Finally, there is the tourism domain that numbers two systems—most notably, the one for the U.S. National Park Service (NPS) introduced in 1972. This is a relative low number, which might be attributed to a lack of pictograms in the tourism domain that matched the desired DOT referents.

# Categorizing Image Contents and Tracing Their Origins on a Chart

## Subcategorizing image contents for referents

Tracing the introduction and development of image contents of referents over time necessitated an organizational framework. A thorough look at the DOT report showed that the AIGA had given each referent a page where allocated pictograms were subcategorized based on similarities in image contents. These pages demonstrated that image contents of pictograms for most referents were generally similar or dissimilar, with not much intermediate image contents being available (Figure 3). That is why for this research, a

Figure 3



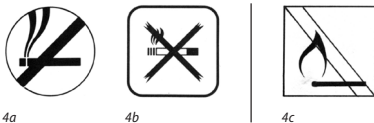
categorization approach was also used, which raised the following question: When should contents be identified as part of a new category? In the DOT research, it was not clear what exact categorization criteria were used. In this research, a pictogram is categorized differently when its image contents—as defined by the objects depicted in silhouette—differs from that of other pictograms for the same referent. Ignored for the purpose of categorization were (Figure 4):

- 1 General applicable image contents or sub-signs such as sign shapes, negations, and pointers;
- 2 Repeating image contents (multiples). Example: depicting two suitcases instead of one;
- 3 The composition of image contents within a pictogram;
- 4 The addition of a slightly different type of the same image contents (generalization). Example: showing different shapes of suitcases to symbolize a more inclusive category;
- 5 The addition of a minor clarifying element to image contents (specification). Example: attaching a small label to a suitcase. Exempted from this were referents, where detail differences in image contents of pictograms suggested major functional differences between them. A good example of this is the referent “water transportation,” which included pictograms of ferries, as well as tour boats. In this case it is likely that the DOT wanted a generic referent for water transportation, where earlier, two different referents would have been used, such as ferry and touring boat.

Figure 4

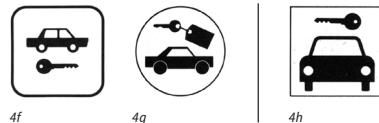
**Borders and negation bars: ‘No Smoking’**

Signs shapes and negation bars were ignored in the categorization of these ‘No Smoking’ pictograms. The ones with the cigarettes (4a, 4b) were categorized differently from the one with the match (4c).



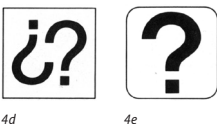
**Composition and silhouette: ‘Car Rental’**

The two left ‘Car rental’ pictograms (4f, 4g) were categorized similarly, ignoring the position of image contents. Also ignored was the label as a minor clarifying element. The right pictogram (4h) had a different car silhouette and got its own category.



**Multiply: ‘Information’**

Repeating image contents (multiply) in these ‘Information’ pictograms was ignored (4d, 4e). Therefore both information pictograms were categorized similarly.



**Generalize and specify: ‘Baggage claim’**

Suitcase shapes (generalize) and minor clarifying elements like labels (specify) were ignored in these ‘Baggage claim’ pictograms (4i, 4j). The rollers at the right pictogram (4k) were a major new element. Therefore pictogram (4k) was categorized differently.



Figure 5

| Year          | Org.    | Telephone |    | Mail |    |    | Currency Exchange |    | Casher |    | First Aid |    | Lost and Found |   | Coat Check |    | Baggage Lockers |    | Escalator Up |     | Escalator Down |     | Stairs Up |     | Stairs Down |  |
|---------------|---------|-----------|----|------|----|----|-------------------|----|--------|----|-----------|----|----------------|---|------------|----|-----------------|----|--------------|-----|----------------|-----|-----------|-----|-------------|--|
|               |         | 1a        | 1b | 2a   | 2b | 2c | 3a                | 3b | 4      | 5a | 5b        | 6a | 6b             | 7 | 8a         | 8b | 8c              | 9a | 9b           | 10a | 10b            | 11a | 11b       | 12a | 12b         |  |
| 1974          | TC      |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1973          | D/FW    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1972          | ADCA    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | BAA     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | LVA     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | O'72    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | Pg      |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | SP      |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | WO'72   |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1971          | FA      |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | Port    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | S/TA    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1970          | ICAO    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | NPS     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | TA      |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | X'70    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1968          | ADV     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | NRR     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | O'68    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1967          | X'67    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1966          | ATA     |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
|               | IATA    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1965          | UIC (2) |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1964          | O'64    |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| 1963          | UIC (1) |           |    |      |    |    |                   |    |        |    |           |    |                |   |            |    |                 |    |              |     |                |     |           |     |             |  |
| Image content |         | 19        | 3  | 11   | 6  | 1  | 13                | 4  | 1      | 9  | 10        | 9  | 4              | 6 | 15         | 3  | 1               | 4  | 2            | 3   | 2              | 3   | 3         | 2   | 2           |  |

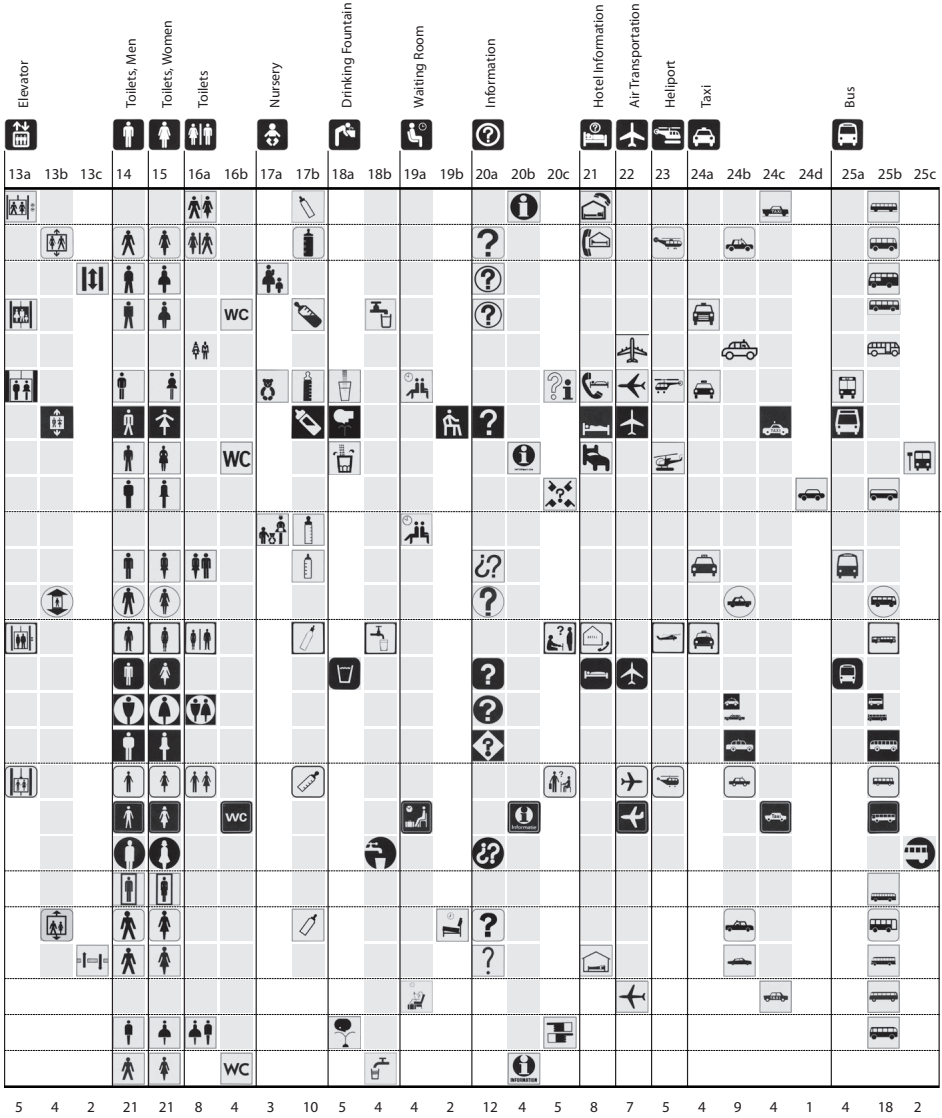
ADCA Australian Department of Civil Aviation  
 ADV German Airports Association  
 ATA Air Transport Association of America  
 BAA British Airports Authority  
 D/FW Dallas-Fort Worth International Airport  
 FA Frankfurt Airport  
 IATA International Air Transport Association

ICAO International Civil Aviation Organization  
 LVA Las Vegas Airport  
 NPS National Park Service  
 NRR Netherlands Railroads  
 O'64 Olympic Games, Tokyo 1964  
 O'68 Olympic Games, Mexico 1968

O'72 Olympic Games, Munich 1972  
 Pg Pictographics  
 Port Port Authority of New York & New Jersey  
 SP Swedish National Parks  
 S/TA Seattle-Tacoma Airport  
 TA Tokyo Airport

## Understanding the categorization chart

The image contents of pictograms were categorized using a chart (Figure 5). The chart enables the reader to trace the development of pictograms for all DOT referents over time, while at the same time making it possible to visually verify the used categorization. The vertical axis of the chart shows



- TC Transport Canada, Air
- UIC (1) International Railroad Union
- UIC (2) International Railroad Union
- W072 Winter Olympic Games, Sapporo 1972
- X67 Expo 67, Montreal
- X70 Expo 70, Osaka

The image contents of pictograms were categorized using a chart, only half of which is reproduced here due to space limitations of the journal - ED.

the chronologically ordered pictogram systems, ranked from the most recent (top) to the oldest (bottom). The abbreviated names for each of these systems can be seen on the left side of each page. The 52 DOT referents are on the horizontal axis, following their original introduction in the DOT Signs Symbols report. They can be seen on the top of each page and are accompanied by their matching DOT pictogram to facilitate quick reading. Underneath each referent, there are one or more numbered columns filled with pictograms with successful or unsuccessful image contents. "Successful

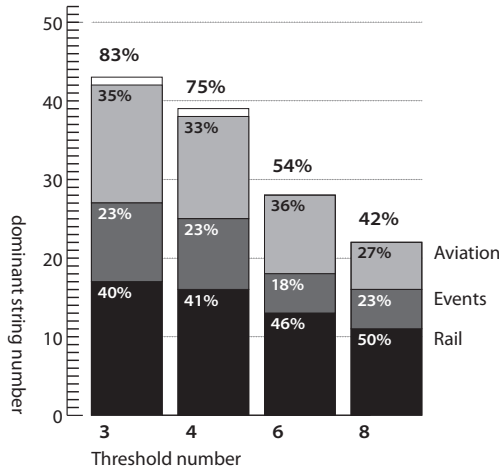
image contents” has similar image contents, that is used in at least three pictograms for the same referent. Such a succession is also referred to as a “string” in this article. “Unsuccessful image contents” is used in less than three pictograms.

## Using “strings” to determine which image contents were successful

Strings are seen as the key to understanding which systems, organizations, and domains were successful or not in introducing new image contents. A good example of a string can be seen with the telephone referent in column 1a (Figure 5). As indicated underneath the column, there are 19 pictograms with similar image contents in this string, starting with the telephone pictogram from the UIC in 1963. Strings are emphasized visually through the use of gray squares in the gaps between its constituting pictograms and the top of the chart. The string with the most pictograms for a referent is the “dominating string” for that referent. For mail, the dominating string can be found in column 2a; it has five more pictograms than the string in 2b. All dissimilar—unsuccessful—image contents for a referent are placed in a separate column, which for the telephone and the mail referents are column 1b and 2c, respectively. If strings for the same referent have the same length—which happened for the period between 1963 and 1974 only for column 11a/11b—the most recent one is considered to be dominant.

A threefold repetition of image contents for a string might seem like a relatively low threshold. It was chosen because some domains were less well-represented than others. Overlooking the negligent tourism domain (two systems), this is especially relevant for the event domain (six systems). The same could be said about the rail domain (two systems) were it not for its considerable overlap with aviation (14 systems) in regard to transport referents. Three is also the minimum number necessary to indicate a repetition of image contents, taking into account that there are two design teams—Otl Aicher’s team and Jock Kinneir and Margareth Calvert’s team—who each designed two systems covered in the chart, with some of these reusing the same image contents (Figure 4). Finally, a threshold of three makes it possible to cover most of the DOT referents: 83%. Using a threshold of four, six, or eight would limit the percentage of DOT referents with strings over the period between 1963 and 1974 to 75%, 54%, or 42%, respectively, lessening coverage for less popular and more domain specific pictograms (Figure 6).

Figure 6



## Categorization Results

### Domain and organization origins of image contents: The “big four”

The categorization of the image contents identified 65 strings during the period between 1963 and 1974, of which 43 were dominant. The railway, aviation, event, and tourism domains were responsible for 40%, 35%, 23%, and 2%, respectively, of the dominant strings, with an almost similar distribution for started strings (Figure 7). This means that 75% of the successful

Figure 7

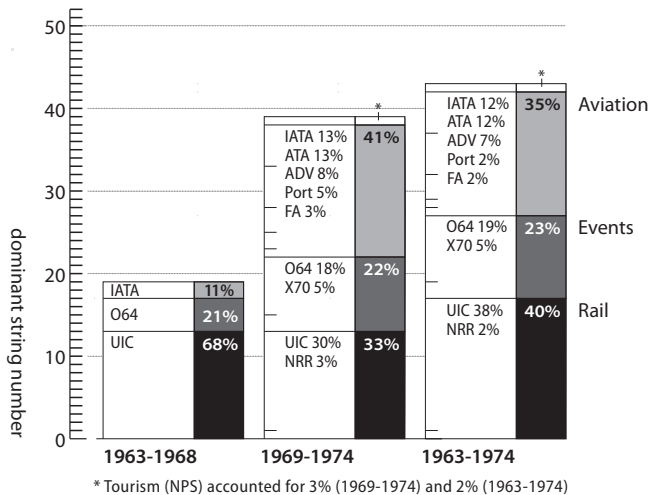


image contents originated in transport organizations. The main entities that introduced dominating strings were the International Railway Union (UIC, 38%), the 1964 Tokyo Olympics (O64, 19%), the International Air Transport



and incoherent sharing—have been categorized as strings because they do show a clear and linked effort to reuse image contents. To some degree, their characteristics can also be found with pictograms for other certain referents, but there it usually concerns the addition or subtraction of only one specific and minor element, rather than multiple elements. Finally, there were nine referents with no strings. Typical for these referents was the low number of pictograms, which reduced the change for establishing strings and suggests a lack of popularity of these referents at the time.

### Connection between domain and image contents

The categorization also showed a slight but discernable connection between domain and the referents for which it delivered dominating strings. Rail, for example, dominates referents associated with luggage, such as “Baggage Lockers,” “Baggage Check-in,” and “Lost and Found,” reflecting the long experience of railways—as the first mass transportation medium—with luggage. Something similar can be seen with aviation that delivered dominant strings for referents, such as “Hotel Information,” “Car Rental,” “Parking,” “Elevators,” and “Escalators.” Services and installations like these were particularly relevant to airports, especially in the United States, where events such as Olympic Games and expos distinguished themselves more with connections to commercial activities, introducing dominant strings for referents such as “Ticket Purchase,” “Coat Check,” “Coffeeshop,” and “Shops.”

## Applying the Categorization Method to Two Current Systems

### Dutch Railways (NS) and Schiphol Airport

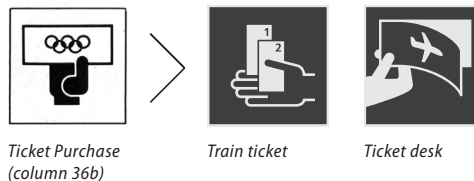
The lack of evolution in image contents between 1963 and 1974 is remarkable. One explanation might be the short time period that was researched. Therefore, it is interesting to see whether image contents have evolved since. To answer this question, the referents and image contents from the DOT evaluation were compared with those of two more recent systems. The main question is: What percentage of image contents for similar referents in these recent systems was already introduced in the pioneer period? This research question also made it possible to experiment with matching the referents and image contents of these new systems with those of the DOT evaluation. Based on only two samples, it is obvious that any results are not generally applicable. However, it is enough to obtain a quick impression.

The first of the two more recent pictogram sets being researched is of the Dutch Railways. This company is also referred to as NS, and is the main operator for railway transport in the Netherlands. An earlier incarnation of the NS set was part of the evaluated DOT pictogram sets under the abbreviation NRR. It was drastically redesigned and expanded in the late 1990s by the Dutch wayfinding specialist Mijksenaar. This agency also designed the pictogram set of Amsterdam Schiphol Airport in the early 1990s, which is the second set to be researched. Both sets have received updates since that time, and the versions being used here are from 2017. Compared with the sets used in the DOT research, those of the Dutch Railways and Schiphol Airport are very extensive, containing 121 and 280 signs and pictograms, respectively.

## Matching referents and image contents becomes more challenging

In the NS set, a large number of pictograms were signs with only letters, numbers, and pointers that were used to indicate platforms. After removing these, circa 70 pictograms were left, which were relatively easy to match. Remarkable was the occurrence of a so-called joined match (j). A good example of this concerns the NS referent “Food and drinks,” which was equivalent to the DOT referents “Restaurant” and “Coffee shop” together. Its opposite was the more common split match (s). In this, a DOT referent was split into several others that were equal in importance or value such as “Rail transport,” which was split into the referents “Tram,” “Train,” and “Metro.” Similar matches could also be seen with the Schiphol Airport set, for example with “Litter Disposal” and “Ticket Purchase” (Figure 10). With split matches, additional elements for image contents were acceptable as long as the main element remained the same. For the calculation of the percentage of similar image contents, split and joined referents were weighted as being equivalent to the originating DOT referents.

Figure 10



The Schiphol Airport pictogram set was more challenging to work with than the NS system, showing severe limitations of using a categorization approach when matching referents and image contents of a large set. After removing duplicate pictograms and signs with only letters and numbers, there were still almost 250 different Schiphol Airport pictograms left. In general there was less semantic distance between

the referents and image contents of this set. Sometimes the referents were totally new, but often it concerned variations on DOT referents that could be considered neither joined nor split matches. Problematic was also that some referents used image contents that were associated with other referents in the DOT evaluation. This made it difficult to establish clear matches, despite there being a connection with earlier pictograms.

A good example of this matching problem can be seen with the DOT referent "Baggage check-in." The Schiphol Airport set has three referents that to some degree matched this DOT referent: "Check-in," "Baggage drop-off," and "Self-service baggage drop-off." (Figure 11) The image contents for the DOT referent "Baggage check-in" was either a suitcase on a weighing scale, or much rarer, a man standing next to a suitcase on an elevation with a pointer, suggesting the suitcase was moving away. This did not match well with the image contents of the matching Schiphol referents. Instead the contents of "Check-in" were more similar to that of DOT referent "Ticket Purchase," and the contents of "Baggage drop-off," and "Self-service baggage drop-off" were more similar to that of the DOT referent "Baggage Claim." In this case, the "Self-service baggage drop-off" pictogram was chosen as the best match for the DOT referent "Baggage check-in." Since the machine was a major new element, this image contents match was weighted half. There were also six other, less challenging matchings in the NS and Schiphol sets, which were accepted and weighted half as well. A good example is the DOT referent "Rail Transport," which in the Schiphol set had a depiction of a train bending in a corner and coming toward the viewer, instead of showing only the side or the front of the train.

Figure 11



## Image contents of common pictograms hardly changed during the last half century

In total, 30 NS referents and 42 Schiphol referents matched with the 52 DOT referents. For these referents, image contents matches were allowed with string and non-string image contents from the DOT research. The results showed DOT image contents matches for 83% of the NS referents (24 fully and three half matched), and 90% of the Schiphol referents (36 fully matched and four half matched) (Figure 12). This suggests that image contents of most common pictograms hardly changed during the last half century. Apart from the increasing specialization of referents, which led to a larger size of pictograms sets, changes that did happen and stand out are those associated with changed processes and behaviors. For example, in the Schiphol Airport set the DOT referent "Litter disposal" has been split into several waste disposal categories, such as "Waste," "Paper," and "PET," –the latter abbreviation indicating plastic bottles. This split suggests shifting attitudes toward waste. The subtlety of these changes can also be seen with the DOT referent for "Smoking." It was introduced in a time when "No smoking" was the exception, while currently, the situation is reversed. This is visible in the Schiphol referent "Smoking area" that emphasizes the delineated "area" for this habit in the referent name, whereas the image contents remain the same as in earlier smoking signs.

Figure 12

| No. | DOT referents      | Strings found       | NS referents                                 | Content origins | Schiphol referents                  | Content origins |
|-----|--------------------|---------------------|--|-----------------|-------------------------------------|-----------------|
| 1   | Telephone          | UIC 19              |  |                 | Telephone                           | UIC             |
| 2   | Mail               | UIC 11 IATA 6       |  |                 | Mail box/Postal services            | UIC             |
| 3   | Currency Exchange  | UIC 13 O64 4        |  |                 | Bank (prev. Cash & change)          | UIC             |
| 4   | Cashier            |                     |  |                 |                                     |                 |
| 5   | First Aid          | O64 10 UIC 9        | EHBO   | O64             | First aid                           | UIC             |
| 6   | Lost and Found     | UIC 9 X67 4         |  |                 | Lost and found                      | UIC             |
| 7   | Coat Check         | O64 6               |  |                 |                                     |                 |
| 8   | Baggage Lockers    | UIC 15 O64 3        | Kluis  | UIC             | Baggage lockers                     | UIC             |
| 9   | Escalator Up       | X70 4               | [Roltrap naar boven]                         | X70             | Escalator [up]                      | X70             |
| 10  | Escalator Down     | FA 3                | [Roltrap naar beneden]                       | FA              |                                     |                 |
| 11  | Stairs Up          | X70 3 UIC 3         | [Trap naar boven]                            | X70             | Stairs [up]                         | UIC             |
| 12  | Stairs Down        |                     | [Trap naar beneden]                          | O72             | Stairs                              | UIC             |
| 13  | Elevator           | ADV 5 ATA 4         | Lift   | ADV             | Lift                                | ADV             |
| 14  | Toilets, Men       | UIC 21              | Heren  | UIC             | Men                                 | UIC             |
| 15  | Toilets, Women     | UIC 21              | Dames  | UIC             | Ladies                              | UIC             |
| 16  | Toilets            | O64 8 UIC 4         | WC   | UIC             | Toilets                             | O64             |
| 17  | Nursery            | ATA 10              | Baby ruimte                                  | ⊗               | Baby care                           | ATA             |
| 18  | Drinking Fountain  | UIC 4               |  |                 |                                     |                 |
| 19  | Waiting Room       | UIC 4               | Wachtruimte                                  | UIC             | (s) Airline lounge   Hispeed lounge | UIC UIC         |
| 20  | Information        | IATA 12 UIC 4       | Informatie                                   | UIC             | Information                         | UIC             |
| 21  | Hotel Information  | IATA 8              |  |                 | Hotel reservation                   | IATA            |
| 22  | Air Transportation | UIC 7               | Luchthaven                                   | UIC             | Vliegveld                           | UIC             |
| 23  | Heliport           | ATA 5               |  |                 |                                     |                 |
| 24  | Taxi               | IATA 9 ICAO 4 UIC 4 | Taxi   | ICAO            | Taxi                                | ICAO            |
| 25  | Bus                | O64 18 NPS 4        | Bus  | O64             | Buses                               | NPS             |
| 26  | Ground Transp.     |                     |  |                 |                                     |                 |
| 27  | Rail Transp.       | NRR 3               | (s) Tram   Trein   Metro                     | NRR Pg ⊗ *      | Train                               | Pg *            |
| 28  | Water Transp.      |                     | Ferry  | UIC *           |                                     |                 |
| 29  | Car Rental         | ATA 7 Port 4        | (j) Eten en drinken                          | UIC             | Autoverhuur                         | Port            |
| 30  | Restaurant         | UIC 13 O64 9        |  |                 | Restaurants                         | UIC             |
| 31  | Coffeshop          | O64 13 O68 4        |  |                 | Food/Coffee bar                     | O64             |
| 32  | Bar                | UIC 8               |  |                 | Bars                                | UIC             |
| 33  | Shops              | O64 8 NRR 5         | Winkels                                      | ⊗               | Shops/Shopping centre               | O64 *           |
| 34  | Barbershop         | UIC 6 Port 3        |  |                 |                                     |                 |
| 35  | Beauty Salon       | Port 3              |  |                 |                                     |                 |
| 36  | Ticket Purchase    | O64 4 ATA 3         | Kaartverkoop                                 | O64             | (s) Train tickets   Ticket desk     | O64 O64         |
| 37  | Baggage Check-in   | UIC 8               |  |                 | Self-service baggage drop-off       | ATA *           |
| 38  | Baggage Claim      | IATA 7 ICAO 4 ATA 3 |  |                 | Baggage belt                        | O72             |
| 39  | Customs            |                     |  |                 | Customs                             | O72             |
| 40  | Immigration        |                     |  |                 | Passport control                    | O72             |
| 41  | Departing Flights  | ATA 11              |  |                 | Departures                          | ATA             |
| 42  | Arriving Flights   | ATA 10              |  |                 | Arrivals hall                       | ATA             |
| 43  | Smoking            |                     | Roken  | UIC             | Smoking area                        | UIC             |
| 44  | No Smoking         | UIC 10              | Niet roken                                   | UIC             | No smoking                          | UIC             |
| 45  | Parking            | ATA 4               | Parkeren                                     | ATA *           | Parking                             | ATA             |
| 46  | No Parking         | NPS 4               |  |                 | No Parking                          | ⊗               |
| 47  | No Dogs            | ADV 4               | Geen honden                                  | ADV             | No dogs                             | ADV             |
| 48  | Entrance           | UIC 4               | Ingang                                       | UIC             | No entrance                         | IATA            |
| 49  | No Entry           | IATA 6 X70 5 UIC 3  | Geen toegang                                 | X70             | Arrivals hall/Exit                  | FA              |
| 50  | Exit               | O64 5               | Uitgang                                      | O64             | Fire extinguisher                   | Pg *            |
| 51  | Fire Extinguisher  |                     | (s) PMD   Restafval   Schoon en droog papier | ⊗ ⊗ ⊗ ⊗         | (s) Waste   Paper   PET             | ⊗ ⊗ ⊗ ⊗         |
| 52  | Litter Disposal    |                     |  |                 |                                     |                 |

Rail   
 Events   
 No match  
 Aviation   
 Tourism   
 Match with a non-string pictogram

(s) Split match    \* Weighted half  
(j) Joint match

## Conclusion

### Most image contents of common wayfinding pictograms originated in transport organizations and hardly changed over time

Three quarters of the most used image contents for wayfinding pictograms originates in transport organizations. Particularly surprising is the pioneering role of the International Railway Union (IUC) that delivered almost 40% of the most used image contents for common pictograms during the pioneer period. This is remarkable because the railways were not known to be the most progressive domain at the time. That role was allocated to aviation, which contributed another 35% of the image contents, mainly originating from the International Aviation Transport Association (IATA) and Air Transport Association of America (ATA). Events contributed only 23% of the image contents, the majority of which came from the 1964 Tokyo Olympics. Research into two more recent sets suggests that to this day, these percentages did not change much. This also means that known designers and the international events for which they designed, such as Olympic Games and World Exhibitions, played a minor role in introducing image contents for pictogram systems during the pioneer period. It is likely that their work was more in the area of systemizing known image contents and improving their visual perception and aesthetics.

81% of the image contents of pictograms was introduced in just three years: 1963–1966. The lack of evolution in image contents thereafter suggests that the first organizations or events to introduce contents for a certain referent had an advantage in introducing image contents. This can be well observed with the pictogram systems for the IUC and the Tokyo Olympics, which were the first systems to be introduced. Their pictograms were unique in that they were developed almost simultaneously, and as a result, the strings that they started were also the ones competing the most for certain DOT referents. One explanation for the stability in image contents over time is the tendency among transport organizations in particular to follow existing standards—in other words, institutional compliance. At the same time, societies as a whole might have a tendency to stick with known image contents. There are many instances in which image contents already existed as symbols before their incorporation in a pictogram set. Typical examples are the symbols for train, glass, or fork and knife, which can be found in timetables from transport organizations from the end of the 19th century onward. Other symbols can be found in traffic signs, maps, travel guides, and visual statistics, such as Isotype.

## The categorization method has limitations

This research investigated the introduction and evolution of image contents in pictogram systems during the pioneer period by developing a method for categorizing image contents and drawing meaningful conclusions from the results. Since image contents in the DOT research hardly evolved, this research was conceptualized as a “survival of the fittest” between successful image contents and not successful image contents, the former being visualized as “strings” in a chart. A major advantage of this method is that enables others to visually verify the choices made when categorizing image contents. It also introduced and successfully applied categorization rules for the pictograms sets used in the DOT research. Nevertheless, this method does have limitations. After all, this research benefited greatly from the fact that at the time, pictogram systems were relatively small, with a large semantic distance between referents, and a similarly large distance between image contents as well.

An assumption in this research was that referents would provide a stable anchor for researching the development of image contents over time. However, the follow-up research with the NS and Schiphol pictogram systems demonstrated that especially in large sets with less semantic distance between referents, as well as image contents, matching becomes more difficult. The relationship between referents and image contents can be subject to subtle change over time. This makes it difficult to use a fixed referent list like that of the DOT as a standard for measuring change. Therefore, before engaging in further research into the image contents of pictograms, it is helpful to establish a theoretical framework first to inform a methodological approach that takes potential instability of both referents and image contents over time into account. It is hoped that the practical experiences from this research can contribute to developing such an approach.

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Wibo Bakker (1974) is a Dutch design researcher and educator, specialized in design research, design methodology, and design history. Between 2014 and 2020 he was associate-professor and program-director at the Industrial Design Department of the Xi'an Jiaotong–Liverpool University in Suzhou, China. Earlier he worked at several Dutch and Belgium art colleges and universities, most notably as a researcher at the Research Group Visual Rhetoric of AKV|St. Joost (Avans University of Applied Sciences) in Breda. Earlier Bakker studied graphic design at the ArteZ Institute of the Arts in Arnhem, and worked for several years as a designer. Later he obtained a BA and MA in Language and Culture Studies, followed by a PhD in Art History (2009) at Utrecht University, dedicated to the development of visual identity, design agencies, and modernism in the Netherlands (1960–1975). For this thesis he won the Jan van Gelder prize of the Dutch Society for Art Historians. It was published by 010 Publishers (Rotterdam) in the prestigious Prince Bernhard Fund for Culture 'Visual Culture in the Netherlands' series, and was also translated in Chinese. Currently he is working on a book about pictogram history and development.

