The Iconicity of Guidance Arrows in Public Transport

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This paper examines differences in public transport guiding arrows across linguistic regions and explores their iconicity from a new perspective. Arrows may appear as universal symbols. As guidance arrows, however, their meanings and systems vary by linguistic context. In Japan, arrows represent the trajectories the passengers have to follow; they point to the path to select in France and indicate the general direction of destinations in Germany. Icons are generally analysed with similarity between form and referent, but similarity cannot explain our case. To discuss this issue, we introduced Monneret's (2014) concept of "mapping" and showed that the operation of "mapping" functions according to a cognitive mode specific to each linguistic culture. This result highlights how language influences the interpretation of visual symbols.
Keywords: Iconicity, Guidance arrow, Cognitive mode

1. Introduction[1)]

Icons are generally analysed based on the similarity between their form and the referent. For instance, the guiding arrow in the subway station corridor shown in Figure 1 can be analysed accordingly.

Figure 1: Guiding arrow to the right

This particular arrow, positioned on the top right side of the panel and circled in white

1) This paper is based on a presentation at the international conference ILL13: Iconicity in Language and Literature, 31 May–2 June 2022.

(Fig. 1), features a horizontally extended shaft with a rightward-pointing tip. Its design, which resembles an arrow moving to the right, aligns with the trajectory (indicated by the dotted arrow in Figure 1) that passengers follow towards the information point. Here, we observe a similarity between the arrow's form and its referent, indicating that, as Vaillant et al. (2001: 57) note, "[a graphic as an icon] speaks directly to the vision, without the intermediary of words", a common assumption about icons.

However, we find distinct variations among the arrows when we examine the actual use of guiding arrows in different language settings. Figures 2 and 3 show the panels that direct passengers to the station exit.

Figure 2: Arrow on exit panel (Japan)[2)]

Figure 3: Arrow on exit panel (France)[3)]

In both examples, passengers move from the foreground to the rear to exit the turnstiles. However, while Japan uses an upward-pointing arrow on its guidance panel, France employs a downward-pointing arrow. These differences indicate that arrow symbols are not universally understood. Furthermore, the arrows cannot be explained solely by a similarity between their shape and the image of passenger movement, as illustrated in Figure 1; neither Figures 2 nor 3 depict a literal ascending or descending movement.

Given these observations, this study aims to address two key questions: How do the observed arrows function within their respective context, and why are distinct arrow forms used to convey the same purpose?

2) Reprinted from "JR Shin-Hakodate-Hokuto Station Shinkansen exit turnstiles.jpg" by Mister0124, cropped, and converted to black and white. The white circle was added by the author of this paper. Retrieved from https://upload.wikimedia.org/wikipedia/commons/1/1d/JR_Shin-Hakodate-Hokuto_Station_Shinkansen_exit_turnstiles.jpg (accessed 25 July 2024). Image licensed under CC BY-SA 4.0.

3) Reprinted from "Gare Val Fontenay RER A Fontenay Bois 18.jpg" by Chabe01, cropped, and converted to black and white. The white circle was added by the author of this paper. Retrieved from https://upload.wikimedia.org/wikipedia/commons/3/34/Gare_Val_Fontenay_RER_A_Fontenay_Bois_18.jpg (accessed 25 July 2024). Image licensed under CC BY-SA 4.0.

2. Guiding arrows in Japan, France, and Germany

In Kurihara (forthcoming), we conducted a comparative analysis of guidance arrows displayed on both hanging and wall panels (denoted "a" and "b" in Figure 4, respectively) across metro and railway stations in three major cities: Tokyo (Japan), Paris (France), and Berlin (Germany).

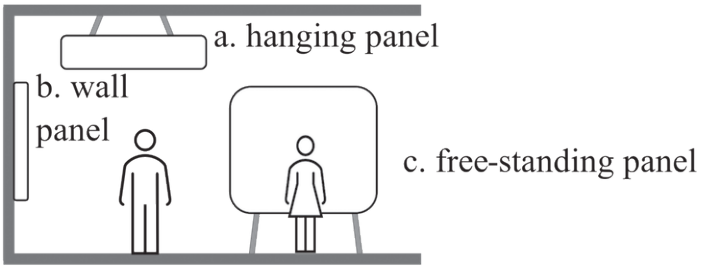

Figure 4: Panel types

The stations also have freestanding panels ("c" in Fig. 4), which we excluded from the study because they serve different functions. Freestanding panels obstruct passenger paths (i.e., prevent further movement) and provide an overview of the station layout. In contrast, hanging and wall panels direct and guide passengers without requiring them to stop, thereby managing the flow of movements[4].

As the corpus was compiled in 2020, during the Covid-19 pandemic, which significantly restricted travel, we relied — apart from Japan — on YouTube videos that meticulously documented entire metro stations and railway stations[5]. Through these videos, we conducted a comprehensive virtual exploration of stations. We covered everything from their exterior entrances to the platform, including nearly every corridor and staircase, to provide a detailed understanding of the station environment. Depending on the size of the station, video durations ranged from 10 minutes to approximately one hour. As these videos were not originally intended for the analysis of guidance arrows, not all arrows were captured. Thus, our study is qualitative rather than quantitative.

4) The guiding arrows in commercial premises function similarly to those in metro and subway stations. However, it would be premature to conclude that the findings of this study apply directly to such environments. Unlike station passengers, whose primary goal is to get to their destination promptly, visitors in commercial settings may not share this single-minded focus. Stations, especially during peak periods, experience large flows of people moving directly to their intended locations, a pattern less common in commercial establishments, except in front of escalators. In commercial environments, additional factors may influence the arrow systems, potentially beyond directing continuous pedestrian flow.

5) The videos referred to are as follows.
Germany: YouTube "MetroCheck" (https://www.youtube.com/c/MetroCheck. Last accessed 25 July 2024.)
France: YouTube "The Explorer" (https://www.youtube.com/c/THEEXPLORER21. Last accessed 25 July 2024.)

Table 1 summarises the types of arrows used in Japan, France, and Germany, highlighting the distinctions between each country's arrow systems.

Table 1: Types of arrows in Japan, France, and Germany

	Up arrow	Down arrow	Right/left arrow	Diagonal arrow	Upward arrow with tip right/ leftward	Right/leftward arrow with tip downward	U-shaped arrow
Japan	+	+	+	+	+	+	+
France	+	+	+	+	−	−	−
Germany	+	+	+	+	−	+	−

In Japan, a wider variety of arrows are utilised compared to France, where simpler arrows are used[6]. This table suggests that the meaning of the arrows differs by country.

In Kurihara (forthcoming), we developed a typology of locations based on the actions passengers take after interpreting orientation signs (e.g., "move forward") and the specific topographies of each setting (such as "corridor leading to an ascending staircase"). Figure 5 below provides an example.

For the "moving forward" action, four topographies were identified: 1) a simple straight corridor that continues, 2) a corridor leading to an ascending staircase, 3) a corridor leading to a descending staircase, and 4) a corridor leading to a fork.

In these diagrams, passengers' actions (movements) are shown as dotted arrows on the ground, while the arrows in the square frame represent the guiding arrows visible to passengers overhead. The human pictograms in the figures represent a person viewing the arrows in front of them, with their back to the reader of the present article. Although in reality, guiding arrows are perpendicular to the ground; we present them horizontally here for simplicity.

These diagrams demonstrate regional variations in guidance arrows and reveal the correspondence (or lack thereof) between the shapes of passengers' potential movement and the shapes of the guiding arrows. Through a 11-case typology, we identified unique arrow systems specific to each country or city's public transport infrastructure.

The following section provides a brief overview of each arrow system's characteristics across the three countries, as established in our previous study.

6) Even in Japan, the number of arrow types is limited in stations with simple layouts.

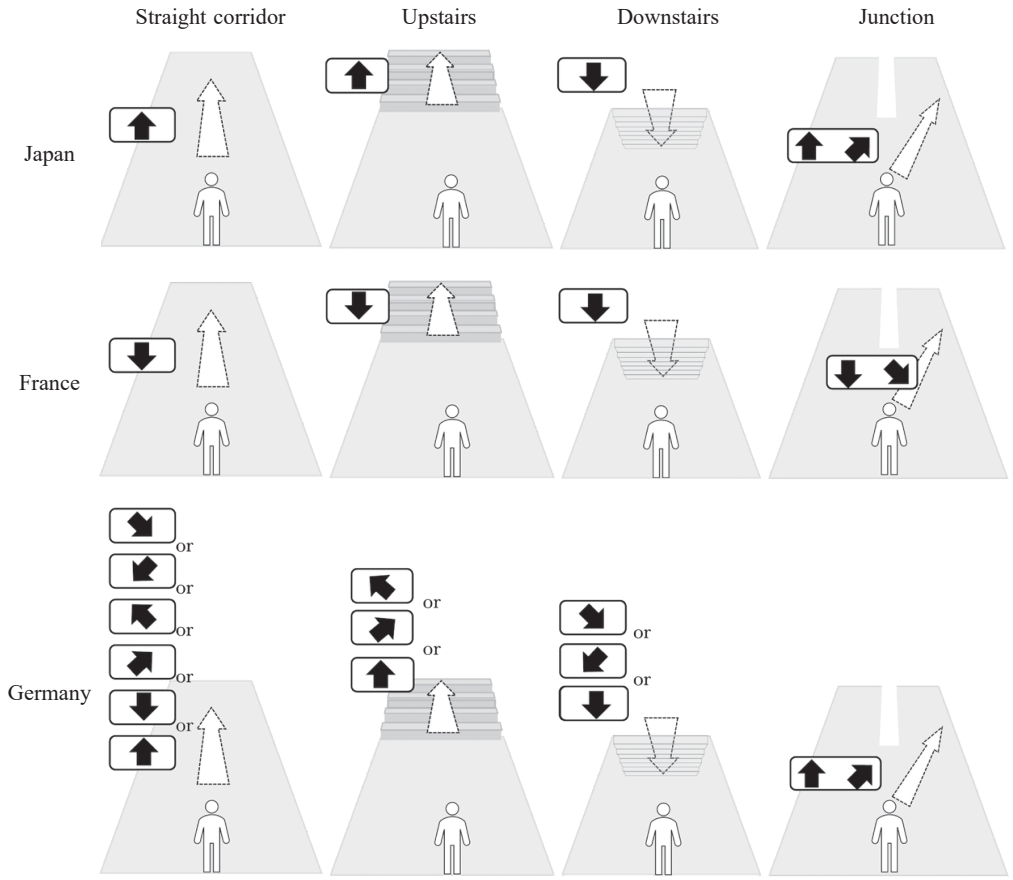

Figure 5: "Moving forward" actions

2.1 Features of Japan's guiding arrow system

The Japanese guiding arrow system is first characterised by its various arrows, as outlined in Table 1. Additionally, the large concentration of panels and arrows within a single location is notable (see Figures 6 and 7).

Figure 6: Many panels-1 (Japan)

Figure 7: Many panels-2 (Japan)

Figures 6 and 7 demonstrate that the guiding arrows in Japan (Tokyo) do not indicate the destination's location at their tips. For instance, the northeast arrow on the left side of Figure 6 does not inform passengers that the destination ("IN") is located on the upper right side (or on the right if the horizontal alignment is transcribed vertically). Instead, it encourages passengers to proceed diagonally forward at this point. Figure 7 illustrates that the arrows do not designate the destination but rather present a trajectory of movement that passengers should trace at the point where they appear. In this instance, three distinct arrows at three locations direct passengers towards the same destination (exits B7, JR, and buses). The arrows first guide passengers to move straight, then to the right, and finally up the stairs. If the arrows indicated the destination, the arrow in the foreground of the diagram would be a rightward, diagonally upward arrow, which is not the case. As discussed below, this is significantly different from the guidance arrows used for public transport in Germany (Berlin).

Figure 8 shows that the guiding arrows of the Japanese (Tokyo) transport system trace the trajectory of movement that passengers trace on the ground.

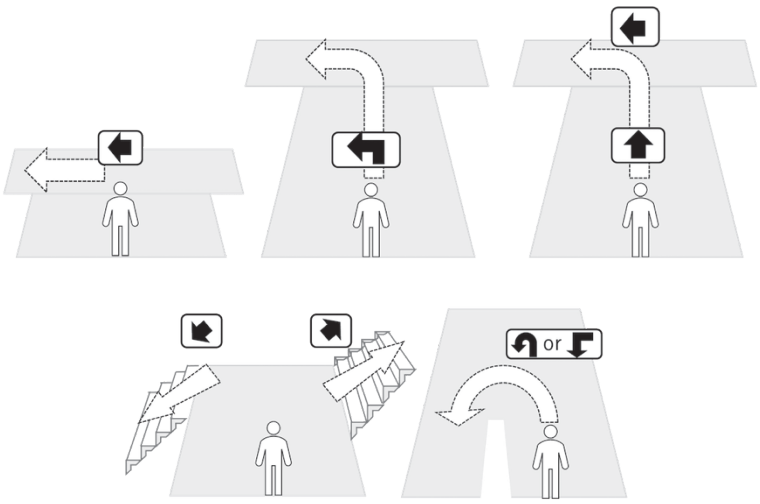

Figure 8: Place's topography, the trajectory of passengers' movement and, the guiding arrow (Japan)

Vertical transcription occurs for horizontal movements; however, the shapes of the dotted arrows on the ground and the guiding arrows generally coincide. This trajectory aligns with the location's topography.

In summary, the trajectory of movement along the topography at a given point influences the choice of guiding arrow type. The variety and frequency of arrows in public transport in Japan (Tokyo) reflect the trajectories of movements corresponding to various topographic

features at several points along the way to the destination.

2.2 Features of the French guiding arrow system

The French system is characterised by a predominance of arrows with a downward point. Notably, these arrows do not necessarily convey the notion of downward movement, as shown in Figure 9.

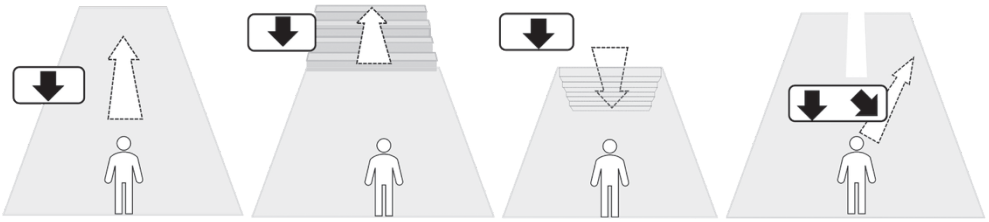

Figure 9: Arrows pointing down (France)

Figure 9 illustrates that the arrows consistently point downward, regardless of whether passengers are moving straight ahead, upward, downward, or diagonally. The arrows' orientation does not clearly indicate the destination's location. In the case of "straight ahead", the arrow may appear to vertically represent passengers' movement trajectory (as illustrated by the dotted arrows in Fig. 9), which is the opposite direction as that of the Japanese case. However, explaining the downward arrow used in a corridor with an ascending staircase using the transcription of the trajectory that passengers take is challenging. In these cases, it could be inferred that only forward movement is represented here. But examining the use of arrows in other topographical settings (Fig. 10) clarifies that the French system's arrows do not map passenger movement trajectories traced on the ground as is the Japanese case. The scenes show passengers being directed to move horizontally to the left, up or down to the left, and up or down from the front stairs located on the left in a metro or railway station in France (Paris). In all cases, a competing use of left, diagonal left-up, and diagonal left-down arrows is observed.

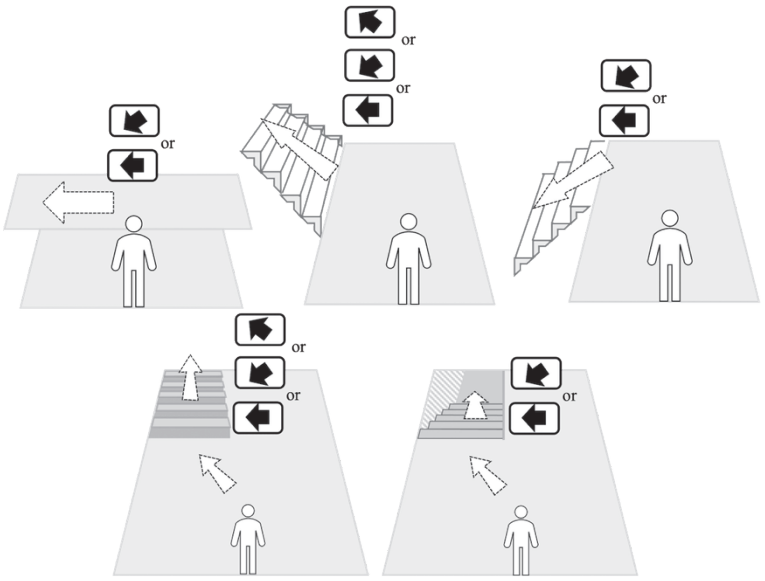

Figure 10: Competing use of leftward, diagonal left-up, and diagonal left-down arrows (France)

The examples above demonstrate that the shape of the passenger movement trajectory is irrelevant in the French arrow system. In France, guidance arrows in public transport point recommended routes, similar to motorway signage indicating the appropriate lane for each destination, as illustrated in Figure 11.

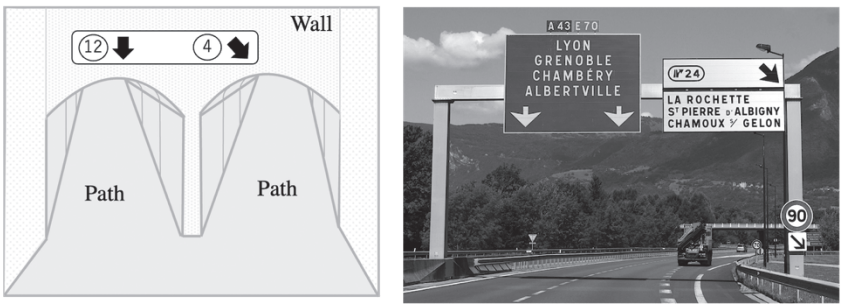

Figure 11: Guiding arrows point the paths to choose (France)[7)]

2.3 Features of the German guiding arrow system

Although the types of arrows observed in Germany align more closely with those in Japan

7) Reprinted from "Autoroute A43 - La Maurienne - 2012-07-16 - IMG 5867.jpg" by Poudou99, cropped, and converted to black and white. Available at https://upload.wikimedia.org/wikipedia/commons/f/fa/Autoroute_A43_-_La_Maurienne_-_2012-07-16_-_IMG_5867.jpg, accessed 25 July 2024. Licensed under CC BY- 3.0.

than in France (see Table 1), Figure 5 above shows that the arrows used in each case do not always match those in Japan. This variation is partly owing to the lower frequency of guiding arrows in German public transport (Berlin). In Japan, multiple arrows often appear along a route to a specific destination, whereas in Germany, a single arrow is used. This contrast is illustrated in Figures 12 and 13.

Figure 12: Multiple arrows (Japan)

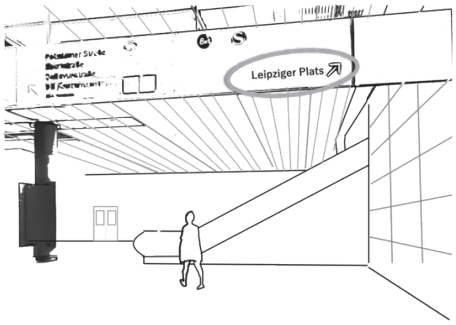

Figure 13: Single arrow (Germany)

In these cases, passengers proceed straight for several meters toward their destination and then ascend the escalator to the right. In Figure 12 (Tokyo, Japan), an upward arrow is visible in the foreground with a right-up diagonal arrow in the background. Conversely, in Figure 13 (Berlin, Germany), a right-up diagonal arrow appears prominently in the foreground. This indicates that, in Japan, guidance arrows align step-by-step with the trajectory of passenger movement, unlike in Germany[8].

Figures 14 and 15 illustrate that, unlike the Japanese guidance arrow system, German guidance arrows do not map out the exact trajectory of movement for passengers to follow on the ground.

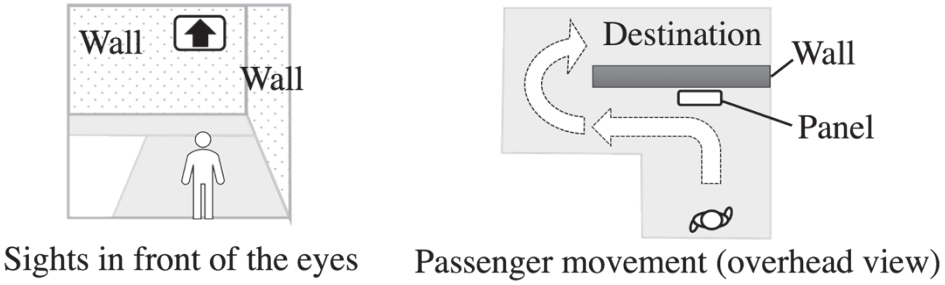

Figure 14: Move around the wall arrow (Germany)

8) As they are not required to represent a trajectory, the size of the arrows is small.

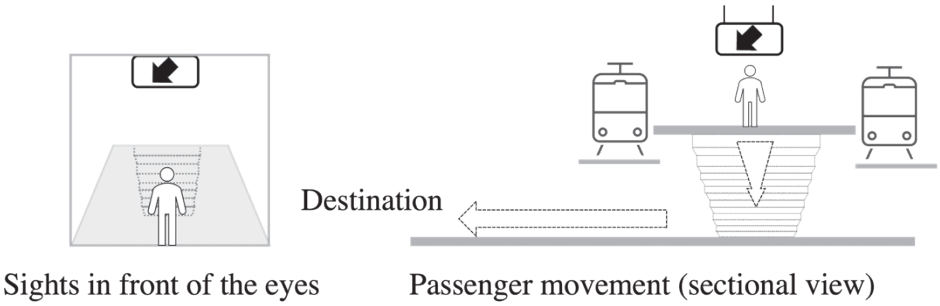

Figure 15: Move downward and to the left arrow (Germany)

In Figure 14, the immediate trajectory of the passengers involves a left turn, while in Figure 15, the descent proceeds in a straight line. If these movements were transcribed into arrows, they would appear as a leftward arrow and a downward arrow, respectively. However, an upward arrow and a diagonal left-down arrow were actually used. We can interpret the purpose of these arrows by examining the broader passenger movement beyond this specific point. In Figure 14, passengers bypass the wall in front by moving to the left to reach their destination. In Figure 15, they descend the stairs and continue a few dozen meters to the left. Based on the position of the arrows, the destination lies in the forward direction in Figure 14 and a down-left direction in Figure 15. The upward and diagonal left-down arrows, therefore, indicate the general direction toward the destination[9]. Passengers consider the specific path details, such as turning right or descending stairs, with this indicated direction in mind, adjusting their movement accordingly to align with the spatial layout and orientation.

2.4 Section 2 summary

For each country, the arrow system described above can be compared as follows:

9) As the destination in this case is not located above, it is assumed that the horizontal direction, forward, has been transcribed vertically to facilitate convenient display on the guidance panel. Although the presence and method of this horizontal-to-vertical transcription warrant further investigation, this analysis will be deferred to a subsequent article.

Figure 16: Passengers' movement

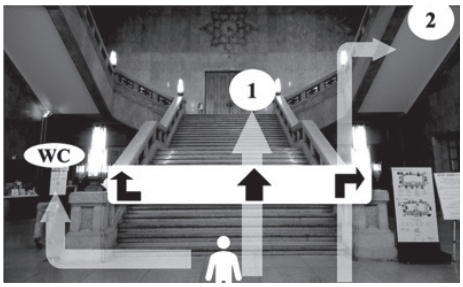

Figure 17: Japanese system

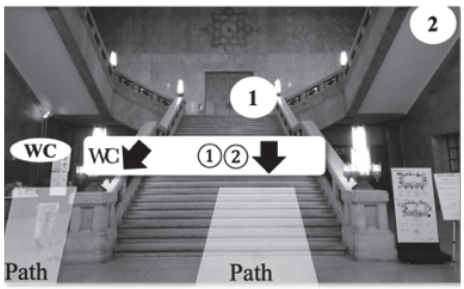

Figure 18: French system

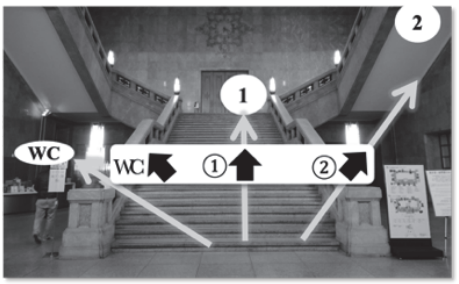

Figure 19: German system

In Figures 16–19, circled letters and numbers represent destinations. In Figure 16, the white lines represent the actual trajectory of passenger movements on the ground. Figures 17 through 19 display the typical guidance arrow systems in Japan, France, and Germany, respectively, with light-grey diagrams depicting each country's arrow design.

At first glance, it is clear that the systems in each country differ: In Japan (Fig. 17), arrows shapes, particularly the straight-line sections, align closely with actual movement trajectories (as shown in Fig. 16). Here, the guiding arrows represent the trajectory of passenger movements, as indicated by the light grey diagrams in Figure 17. The French system, however, predominantly employs downward-pointing arrows to denote the selected route (Fig. 18). In Germany, the arrows connecting two points (the panel and destination positions) indicate the general direction of the destinations from the panel positions[10] (Fig. 19).

We can translate the instructions of the respective systems as follows: Japan's arrows mean "Move this way" or "Trace this trajectory"; France's arrows signal "Go from here" or "Choose this path"; and Germany's arrows indicate "Proceed in this direction" or "Your destination is in

10) Of these two reference points, we intentionally specify the position of the guidance panel rather than the passengers' position. This approach is taken because, in the German context, as shown in Figures 14 and 15, the direction indicated by the guiding arrow remains effective in guiding the passenger's route even after they have moved beyond the panel's location. Thus, it is not the directional relationship with the passengers themselves, but rather the fixed spatial relationship between the panel and the destination, that proves crucial.

this direction". Although applied similarly within station layouts to guide the movement of passengers, these systems use arrows to construct different meanings. This difference leads us to ask: How is the meaning of the guidance arrows constructed?

3. Constructing the arrow's meaning as an image icon

The different semantic roles of arrows, such as direction, movement, change, and order, have already been noted and classified. Lavarde (1996) returned to their origins and classified them into two categories, depending on whether they correspond to an arrow (as a weapon) or a pointing finger. The concept of similarity cannot explain this diversity of the semantic roles of the arrow. As for analytical approaches describing arrows (or icons) semantic construction without similarity concept, we can mention those of Vaillant et al. (2001: 70–72) and Kurata et al. (2005; 2006). Monneret (2014), on the other hand, attempts to redefine the notion of iconicity and also introduces the concept of analogy ("mapping"), in the cognitive sense.

3.1 Vaillant et al. (2001: 70–72); Kurata et al. (2005; 2006)

Vaillant et al. argue that icons are "iconic texts (*textes iconiques*)". They can be deconstructed into parts, and the meaning of icons is defined by the combination of the properties of their parts. As shown in Figure 20, these authors deconstruct icons into their constituent parts and identify the icons' meaning based on the characteristic connotations of each part and their combinations.

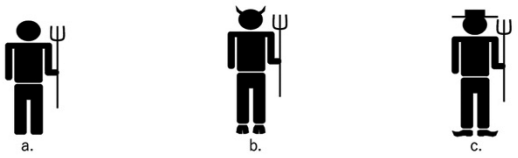

Figure 20: Analysis by Vaillant et al. (2001: 71)

Kurata et al. mainly discuss arrows. As detailed in Figure 21, they analyse arrows' meanings, by examining the semantic content of the linguistic expressions and symbols associated with the arrows and their position relative to the arrows.

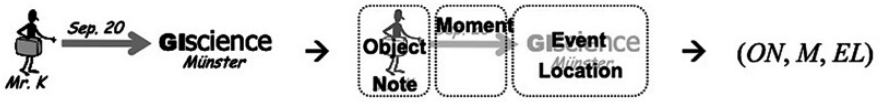

Figure 21: Analysis performed by Kurata et al. (2006: 2)

However, these analytical approaches are difficult to apply to our case because guidance arrows have the same parts (a straight line and a triangle) and the same accompanying element (a logo representing a transport line). Given this, how, exactly, is the arrow's meaning constructed differently in the public transport context, in all of the three countries under consideration? To address this question, we would like to rely on the conception of the analogy ("mapping"), which Monneret (2014) puts forward in his new definition of the image icon.

3.2 Monneret (2014)

Like the previous authors, Monneret (2014) also challenges defining "icon" in terms of the similarity between form and referent; as such, he introduces the notion of analogy ("mapping") as an alternative. He thus redefines iconicity as "a particular case of analogy" (Monneret 2014: 5). Here, analogy, or mapping, is a cognitive process, as Monneret explains below:

> [Mapping] is carried out between a "source" or "base" (the most familiar or concrete situation) and a "target" (the new or less familiar situation). It consists first of all in an "alignment" of the source and the target of the analogy, i.e., in the identification of a relational structure common to the source and the target from the one-to-one correspondence of some of their constituent elements and their relations. (Monneret, 2014: 13)

In particular, this definition, which is based on the concept of analogy, makes it possible to distinguish between the image icon and the diagrammatic icon, while also treating them within the same framework of iconicity. What is more, the distinction is made through the "specification of the entities between which the relation of analogy is established". Thus, the image icon can be defined as "an analogy involving qualities, that is, the intrinsic properties of signifiers" (Monneret, 2014: 5).

By means of the formulation "intrinsic properties of signifiers", this definition might seem similar to Vaillant et al.'s, who argue that an icon derives its meaning from the combination of

meanings characteristic of the lines that compose it. However, Monneret's argument differs in this important respect: the meaning construction of the image icon results from a cognitive process that maps an inherent feature(s) of the icon to some recognisable property (or properties) of the referent. This means that the properties taken into account depend on the mapping and thus the icon's meaning can be variously defined, depending on the relationship with the referent.

Monneret's approach thus enables us to explain the differences among the diverse meanings of the guidance arrows used in equivalent situations and for the same purpose, according to the different ways the mapping is done. With this in mind, the following sections go on to describe the differences in mapping among the Japanese, French, and German guidance arrow systems.

3.3 Mapping in the Japanese, French, and German arrow systems

First, we will confirm the arrow's inherent properties, which have already been described by Tversky (2001) and Kurata et al. (2005). Tversky (2001: 95) defined an arrow as "a special kind of line, with one end marked, inducing an asymmetry. Although they have many uses, a primary one is to indicate a direction, an asymmetric relation." Building on this definition, Kurata et al. (2005: 234) further described the two essential characteristics of arrows, which are linearity and asymmetry: "Asymmetry makes it possible to represent a direction or an order, whereas linearity makes it possible to represent a length, a path, or a connection".

To explain the divergent meanings of the guiding arrows between the three countries, we examine with which property (or properties) the mapping is done for each of these countries. Let us take Figures 17 through 19 as Figure 22 through 24:

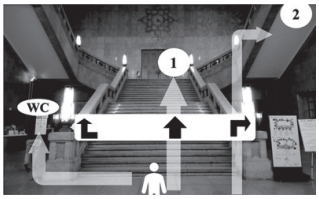

Figure 17=22:
Japanese system

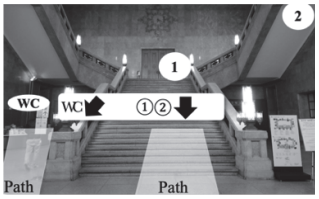

Figure 18=23:
French system

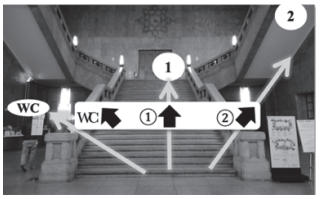

Figure 19=24:
German system

In Japan (Fig. 22), we can see that the lines' shape (shaft) is most relevant. This is confirmed in that the erasure of the pointed parts (tips) does not necessarily prevent a correct reading of the arrow symbols, except for the arrows on the left and the right. The meanings of

the Japanese arrows are constructed by mapping involving the arrow's property of linearity, a property which represents a path. For the French arrow system (Fig. 23), where arrows point to the location of the route to choose, the mapping takes the pointed parts (i.e., property of asymmetry) for its operation. Finally, in Germany, the mapping is done with both properties: the linearity connecting two points and the asymmetry marking which of these two points is the destination (Fig. 24)[11].

None the less, it remains necessary to clarify why the mapping is done differently in Japan, France, and Germany.

4. Guidance arrow systems and cognition modes

This section explores the differences in various mapping systems for guidance arrows across the three countries, following Nakamura's (2019) theory of cognitive modes. This theory addresses not just the position of the viewer's perspective but also the interactive relationship between viewer and context in constructing cognitive images. After summarising Nakamura's cognitive modes (4.1), we analyse the cognitive modes in Japanese, French, and German languages (4.2) and apply these to arrow mapping in each system (4.3).

4.1 Nakamura's (2019) cognitive modes

Nakamura's cognitive mode theory critiques the traditional "seeing-seen" cognitive framework, such as Langacker's (1985), which posits an independent, oppositional relationship between the cognitive subject and the object, assuming that each is defined as an independent entity. Nakamura argues that cognition "emerges through the interaction between the subject and the object of cognition" (Nakamura, 2013: 1). The primordial mode of cognition refers to the state of cognition during this interaction in which the cognisant subject has not yet developed the ability to objectify itself or the object of cognition. Nakamura refers to this mode of cognition as "I-mode (Interactional mode)". A typical manifestation of cognition in the I-mode is the interjection "Ouch!" in response to pain. Here, the subject interacting with the pain signal expresses this intuitively and does not have the perspective of analysing the relationship between the pain subject (themselves) and the object of pain. Cognition from a perspective immersed in interaction means that the perception of an object or a state of affairs

11) Note that this analysis is valid for guiding arrows intended to control the flow of passengers during their movement. For the freestanding panels that present the station structures in a bird's-eye view to stopped passengers, we expect the arrows' mapping to operate differently from this.

and the construction of its cognitive image take place, so to speak, simultaneously. Therefore, I-mode cognition is characterised by three key features: 1) The field of interaction is integral to the construction of cognitive images, 2) this construction begins with a reference object that is easily accessible to the subject and progresses gradually (referred to as "reference-point cognition"), and 3) the state of affairs is captured in progress (termed "non-bounded cognition").

Nakamura posits that the subject, while involved in the field of interaction during cognition, can detach their perspective from the field of interaction and recapture ("meta-cognise") the state of affairs. This is termed the "D-mode (displaced mode)". An example is the utterance "I have pain" in response to the perception of pain, where the conceptualiser adopts an objective viewpoint, seeing themselves as the possessor of pain, an element within this state of affairs. The following three points characterise D-mode cognition: 1) The interaction field does not influence the construction of the cognitive image, 2) the cognitive image is formed analytically from a bird's-eye, objective perspective that captures the entirety of the state of affairs ("landmark-trajector cognition"). In other terms, the cognitive image is not built by constructing an easily accessible reference object but by capturing the elements of the state of affairs and connecting the two elements that stand out, and this bird's-eye perspective allows for 3) the viewing of the state of affairs not in its development but summarily ("bounded cognition").

Nakamura (2019) classified various linguistic features in English and Japanese according to the three characteristics of each mode and identified the cognitive mode that each language tends to adopt. For example, English only uses "I" as the first-person pronoun for the speaker, but Japanese has a variety of expressions, such as "*boku*", "*watashi*", "*ore*", and others. This indicates that, in Japanese, the speaker's cognitive image is constructed through interacting with the interlocutor in a dialogue. These first-person pronouns represent the I-mode aspect of Japanese.

The distinction between the I- and D-modes is not dichotomous. According to the dominance of the I- or D-mode aspects manifested by linguistic features, each language is situated somewhere on a continuum, with languages typical of each mode at two extremes. Thus, we examine where Japanese, French, and German are situated on this continuum.

4.2 The cognitive modes of Japanese, French, and German

The above analysis led Nakamura (2019) to conclude that Japanese is a prototypical

I-mode language and English is a prototypical D-mode language[12]. Haruki (2011) considers all of Nakamura's analysis items and analyses the cognitive mode in French. While identifying French as more of a D-mode language, he argues that it operates in I-mode in certain respects. Cognitive modes in German need to be comprehensively analysed. In the following table, we incorporate Nakamura's and Haruki's descriptions of Japanese and French with descriptions of relevant German items mentioned in Abraham (2012), Ozono (2018), and Nakamura (2019). We classified some items not mentioned in Nakamura's cognitive mode framework, referencing descriptions from existing studies in other frameworks. Characteristics of English are also provided for comparison. Table 2 summarises the features of each language, albeit not exhaustively[13]. Following Nakamura, we present items for each cognitive mode feature that are particularly relevant.

Table 2: I-mode/D-mode features

Feature	Japanese	French	German	English
	Cognition in interaction (I) ←– – – – – – – – – – – – → Meta-cognition (D)			
a. Personal pronoun	Varied	Little variation (Pronoun "*on*")	Little variation (Pronoun "*man*")[14]	Unvaried
b. Middle construction	Property Experience	Property Experience	Property[15]	Property
c. Double object construction	Dative of interest possible	Dative of interest possible	Dative of interest possible[16]	Dative of interest impossible
	Reference-point cognition (I) ←– – – – – → Landmark-trajector cognition (D)			
d. Topic or subject[17]	Topic	Subject (Topic)	Subject (Topic)	Subject
e. "Do" language or "become" language	Become	Do (Become)	Do[18]	Do

12) This is a general tendency and does not preclude the formation and description of cognitive images in the D-mode in Japanese when analytical descriptions are required.

13) Unless otherwise specified, the classifications follow Nakamura's work for Japanese and English and Haruki's for French.

14) We categorise German as exhibiting "little variation", as it includes a linguistic element, *'man'* , which serves a function analogous to the French pronoun "*on*".

15) German middle constructions are noted to primarily represent properties (Fagan, 1992).

16) Nakamura (2019: § IV and § IX).

17) Haruki (2011) and Abraham (2012), while affirming that French and German predominantly follow a subject-verb rather than a topic-comment structure, also note that topic structures are frequently used, thus characterising them as aligned with the I-mode aspect. However, according to Li and Thompson (1976), French and German, as Indo-European languages, are subject-prominent because they lack specific linguistic markers for a topic, such as "*wa*" in Japanese. Consequently, we position the tendencies of French and German as intermediaries between the I-mode and D-mode.

18) Abraham (2012).

	Non-bounded cognition (I) ←– – – – – – – – – – → Bounded cognition (D)			
f. Verb frame or satellite frame	Verb frame	Verb frame	Satellite frame[19]	Satellite frame
g. Reported speech	Direct speech	Direct speech Free indirect speech Indirect speech	Direct speech Experienced speech Indirect speech[20]	Direct speech Indirect speech

In Table 2, the dark grey boxes indicate the features that qualify as I-mode, the white boxes indicate the features that qualify as D-mode, and the light grey boxes indicate that some I-mode features exist. We have yet to examine all items provided by Nakamura; therefore, further detailed and exhaustive comparisons are necessary. However, we can state the general cognitive mode trends for each language as follows: Japanese is a prototypical I-mode language, English is a D-mode language, and French and German fall between the two categories. Between these last two, French is the furthest from English, as it exhibits more features in the I-mode, whereas German more closely resembles the D-mode.

4.3 Cognitive mode and the mapping of guidance arrows

We now examine the mappings of the guidance arrow systems in public transport in each country (each city) from the perspective of cognitive modes. The focus is on how the three characteristics of modes I and D, summarised below, are observed in the mappings of the arrow systems.

—Cognition in interaction (I) or meta-cognition (D)
—Reference-point cognition (I) or landmark-trajector cognition (D)
—Non-bounded cognition (I) or bounded cognition (D)

Note that unlike freestanding panels that present a bird's-eye view of the station layouts, suspended and freestanding panels that appeal to moving passengers about their actions at the point where they occur interact with a field of cognition. In this sense, we can observe an I-mode aspect in the instructions of the latter type of panel. On this basis, the focus of this section is not the actions of passengers after interpreting the arrows (i.e., the perlocutionary act, which is common in all cases) but the meaning construction of the guiding arrow system (i.e., the way mapping functions and the cognitive images formed).

19) This classification follows Talmy (1991), which categorises German as a "satellite framed" language.
20) Ozono (2018).

4.3.1 Cognitive mode of the mapping of Japanese guidance arrows

In the Japanese case, the arrowed linear part maps the shape of trajectories, such as straight, diagonal, and right-angled, as illustrated by the dotted line shapes in Figure 25.

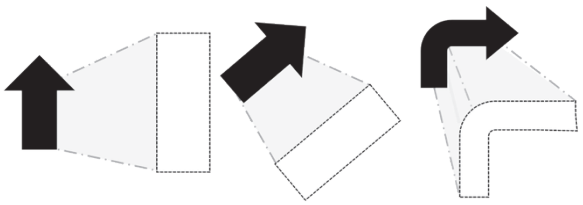

Figure 25: Schematic illustration of arrows mapping the shape of the trajectories

This mapping is highly dependent on the place of passenger arrow perception (cognition in interaction); the appropriate interpretation of arrows is hampered in cases where the same shape as the arrow is difficult to find in the spatial layout of the field in which the arrows appear. As Figures 26 and 27 show, in a spatial layout with only a wall in front, finding oblique or right-angled shapes is challenging, so passengers are forced to look for other clues in the surrounding area that allow them to do this (e.g. a path seen beyond the obstacle on the right in Figure 28 and a left-hand bend in Figure 29).

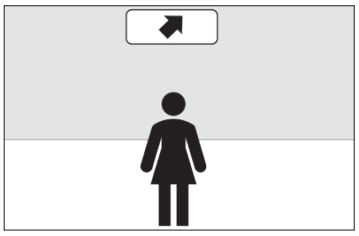

Figure 26: A diagonal arrow on the wall in front of the passenger

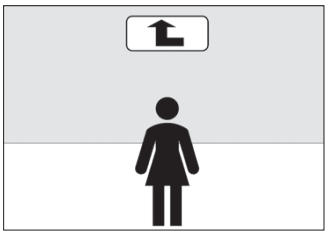

Figure 27: A leftward arrow with a tip upward on the wall in front of the passenger

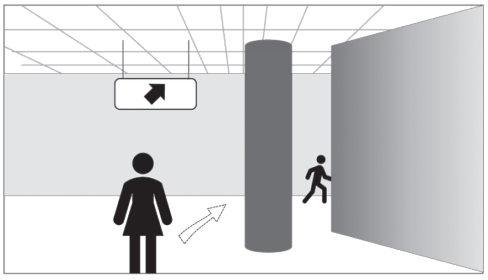

Figure 28: A diagonal arrow captured in the surrounding context

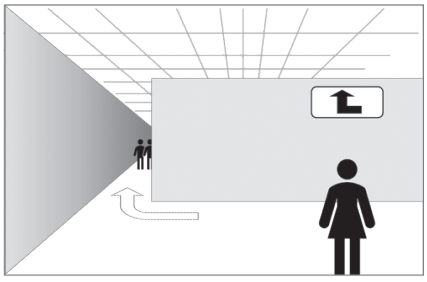

Figure 29: A leftward arrow with a tip upward captured in the surrounding context

Moreover, the moment of passenger arrow perception also influences this mapping type. As described in the comparison of the Japanese and German cases in Section 2, the cognitive image of guiding arrows formed in the Japanese way becomes irrelevant as a guidance instruction to the destination once the passenger leaves the panel's position (i.e., the spatial layout to which they refer changes). This differs from the German case. For example, in the situation illustrated in Figure 28, the diagonal shape is no longer helpful for passengers turning right after following its trajectory.

From the above, we can further conclude that this type of mapping functions in reference-point cognition. The cognitive image of the arrows is progressively formed from the perception of their shapes to the reference of an accessible object in this cognitive field (in this case, a trajectory possible in the immediate spatial layout, resembling the shape of the arrow). This can be confirmed by the mapping inhibited by eliminating the immediate spatial layout properties, as already seen in Figures 26 and 27.

Finally, the cognitive images formed here (the shapes that the passengers image on the ground) represent the trajectories to be followed. In other words, the process is represented, not the outcome, such as the destination. In this respect, a characteristic of non-bounded cognition can be seen.

In summary, on public transport in Japan (Tokyo), the mapping of guidance arrows operates in I-mode, as in Japanese.

4.3.2 Cognitive mode of the mapping of French guidance arrows

In the French guidance arrow system, the tip (triangular) shape is involved in mapping. The triangle triggers the formation of an image of a finger pointing at a path to take[21] (represented in grey colour in Figure 30).

Figure 30: Schematic illustration of arrow mapping a finger pointing at a path to take

21) The cognitive image formed here is not a "finger" but a "finger pointing to an object". This is because, as we will see below, the guiding arrows of the French system do not work in situations without any object to point.

In France, as in Japan, the spatial layout of the place where arrow cognition operates acts on mapping (a feature of cognition in interactions). The construction of this cognitive image requires identifying an object (a path) to which the finger is pointing in the immediate field. Situations where no path can be found as pointed by the arrow (situations described in Figures 31 and 32) block the mapping and make it difficult to interpret the arrows[22].

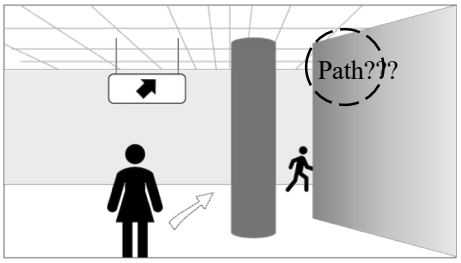

Figure 31: No path above the passenger's right-hand side

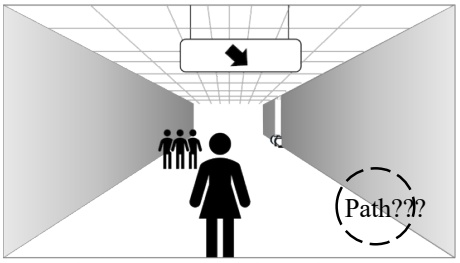

Figure 32: No path to choose in the lower right-hand side of the passenger's immediate front

Therefore, in public transport in France (Paris), arrows are mainly used in the spatial layout presenting multiple paths to be chosen (i.e. to be indicated), as shown in Figures 33 and 34.

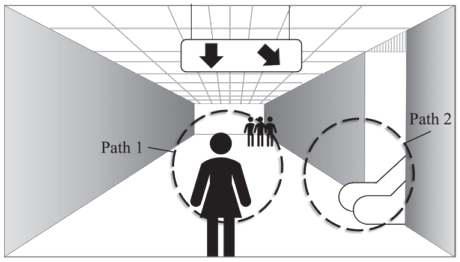

Figure 33: A spatial layout with a staircase on the right presenting multiple paths

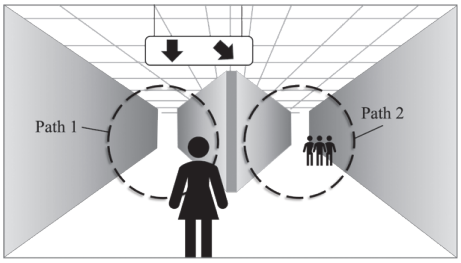

Figure 34: A bifurcated spatial layout presenting multiple paths

The formation of the cognitive image here is linked to the typical operation of reference-point-type cognition. From the reference to an arrow, an image of a finger is formed, which in turn leads to a reference to an object (path) accessible in this cognition field, forming a definitive cognitive image (a finger pointing to a path). On the other hand, the pointing image represents object identification, i.e., momentary operation. The development perspective is not involved then (a feature of bounded cognition). French guiding arrows present both I-mode and D-mode characteristics, similar to those of the French language.

22) The use of arrows like those in Figures 31 and 32 can be observed in Japan and Germany, respectively.

4.3.3 Cognitive mode of the mapping of German guidance arrows

In Germany, a straight line connecting two points is mapped between the point of the panel and the destination, and a triangle points in the direction of the destination.

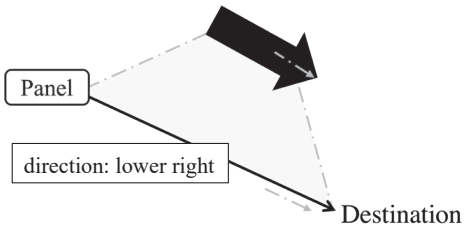

Figure 35: Schematic illustration of mapping using the line and triangular parts of the arrow

Here, the mapping functions are without the constraints of the time and place of the passengers' arrow cognition (a feature of meta-cognition). As shown in Figures 36 and 37, the cognitive images (directions) formed here do not correlate with the spatial layouts of the arrow occurrence fields but with the panel-destination relationships captured from a bird's-eye or cross-sectional view of the station[23].

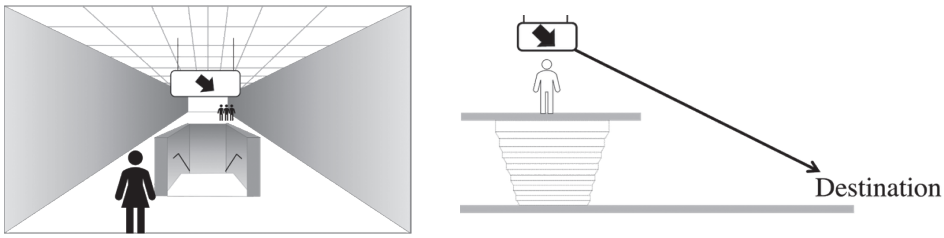

Figure 36: A spatial layout of the arrow occurrence fields and a cross-sectional view of the station

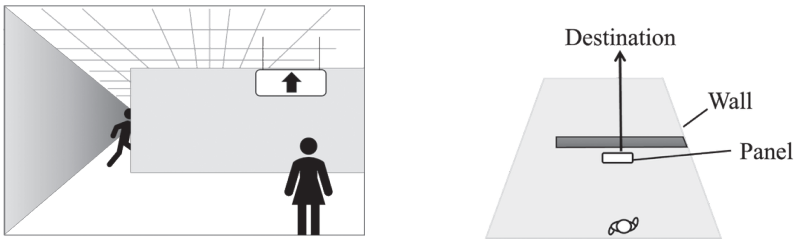

Figure 37: A spatial layout of the arrow occurrence fields and a bird's-eye view of the station

23) The influence of the arrow occurrence fields on the choice between these two perspectives is conceivable. However, the formation of the cognitive images themselves, which are a spatial relationship between the two points, is not influenced by the cognitive field (see below).

The cognitive image formed in this way is involved in the whole movement to the destination. Therefore, referring to only one guiding arrow, the passengers can take multiple trajectories (that do not necessarily correspond to the arrow shapes). This is even after leaving the area where the arrow is visible (see Figures 38 and 39).

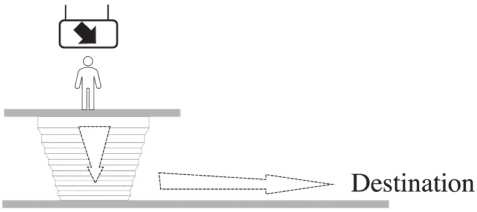

Figure 38: Actual trajectories taken by passengers in the situation shown in Figure 36

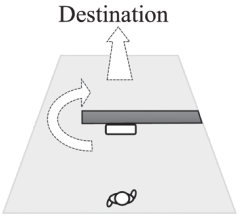

Figure 39: Actual trajectories taken by passengers in the situation shown in Figure 37

The comparison of Figures 36–39 above also clearly shows that the movement process (shown in Figures 38 and 39) is not involved in the German arrow mapping (Figures 36 and 37), which does not work in the non-bounded cognition. Furthermore, the cognitive image is here formed by referring to the arrow origin and tip without considering the cognitive context (a feature of landmark-trajector-type cognition). As seen in Figures 36 and 37 above, for the arrows to function correctly, mapping the destination in the cognitive field is not needed: the destination is given as being in the direction of the arrowhead. Cognitive images that do not represent the exact location of the destination accommodate a wide range of locational relations, summarising the details of the arrangement of the arrow and the destination, as shown below.

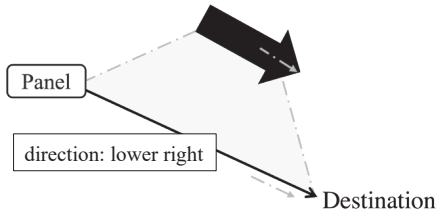

Figure 40=35: Arrow pointing downwards to the right

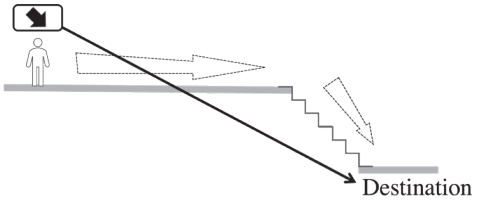

Figure 41: The destination located in the lower right

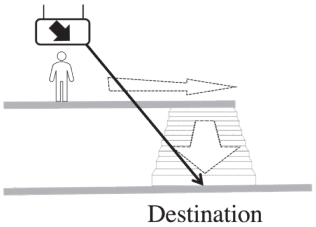

Figure 42: The destination located backward to the lower right

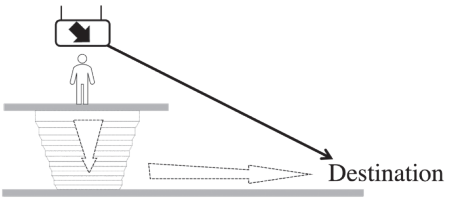

Figure 43: The destination located forward to the lower right

In Figures 41 to 43, the destinations are in the lower right, backward lower right, and forward lower right from the arrow point, respectively. The German arrow system uses an arrow designating the lower right direction (Fig. 40) in all these cases. This also indicates that the cognitive image is formed in an abstracted spatial image away from the concrete cognitive field.

As such, in the German system described above, the guidance arrow mapping functions in the D-mode, as well as the German language.

5. Conclusion

The arrow system in the public transportation context can differ from country to country despite the coincidence of contexts (public transportation), aims (to manage the flow of passengers), results (e.g., passengers' movement to the front), and even spatial layouts of places where arrows occur. The origin of such differences lies in the choice of the arrow's property (or properties) considered in the cognitive operation of mapping the image icons. This choice reflects or is reflected by the cognitive mode privileged by the country's language in question. Further investigation into the relationship between the cognitive modes of other languages, especially English-speaking areas and French-speaking ones other than France, and the mapping of guidance arrows in each linguistic domain are needed to support this result more substantially. Nevertheless, our perspective of which cognitive mode the mapping functions in is a new approach to the cross-linguistic analysis of iconicity. Future applications of this approach to other image icons and linguistic forms of iconicity, such as metaphors, can yield new insights in this field.

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