

# Interpreting Arrows in Static Pictures

Carel van Wijk  
Rosanne Speessen  
Alfons Maes

Tilburg School of Humanities, Communication and Cognition Research Group  
P.O. Box 90153 NL-5000 LE Tilburg, The Netherlands  
chvwijk@uvt.nl R.A.M.C.Speessen@uvt.nl Maes@uvt.nl

**Abstract** An experiment was conducted to determine the interpretation of arrows in static pictures. Participants responded in three ways (spontaneous reaction, yes/no decision, forced choice) to pictures, in which different types of objects were combined with an arrow in one of four positions (either left or right of the object and pointing toward or away from it). An adequate interpretation of the pictures (either referential or attributive) was given spontaneously in two third of the cases. The yes/no decision task resulted in an inconclusive pattern. Only with a forced choice, participants gave specific interpretations. We conclude that an arrow does not by itself have a univocal interpretation in a static picture.

**Keywords:** static picture; arrow; referential; attributive; motion

## Arrows in communicative visuals

In static communicative pictures, arrows rarely refer to pointed shafts used for shooting from a bow. In most cases they are superimposed on the picture as a visual-syntactic cue (Cutting, 2002). In a recent study we observed that in communicative visuals such arrow cues are difficult to interpret, even when their >meaning= is consistent with other contextual cues, like body postures (Hoogwegt, Maes, & van Wijk, 2009). One reason may be the ambiguity of arrow cues in communicative visuals. Comparable to the double interpretation of definite descriptions proposed by Donnellan (1966), arrow cues can be interpreted as referential or attributive. In the first case, they are used to refer or point deictically (1a and 1b). In their attributive use, arrows contribute to the semantics of the visual (1c and 1d). Moreover, arrow interpretations include different degrees of addressee orientation. They can include an explicit instruction to the addressee or not (1b and 1d versus 1a and 1c). In this study, we investigate the different meanings associated with arrows and the variables they are dependent on.

Table 1: Interpretations of arrow cues in static pictures.

| Referential use   |   | Attributive use  |   |
|---|---|--|---|
| - addressee   | + addressee   | - addressee  | + addressee   |
|  |  |  |  |
| 1a The cursor is here   | 1b You are here; Look here  | 1c The slope goes up   | 1d Take the condom out  |

## Research objective

We wanted to know to what extent a picture combining an object and an arrow would elicit a specific interpretation, either referential or attributive, depending on properties of the depicted object (movability, intrinsic orientation) and the arrow (position, direction, colour) and on personal characteristics of users (e.g., need for cognition, visualizer versus verbalizer). We used three methods to elicit interpretations (spontaneous reaction, yes/no decision, forced choice). In this paper we pay minor attention to characteristics of object, arrow and user, we concentrate on the viability of the tasks.

## Materials

Table 2 displays the eight objects that were selected. They differed with respect to two factors: movability (movable or fixed) and intrinsic orientation (symmetrical, directed rightward or leftward). Table 3 displays for one of the objects how the arrow has been combined with the object. Three factors were varied systematically: position (left or right of the object), direction (pointing to the left or to the right) and colour (black or pink).

Table 2: Objects characterized by their movability and intrinsic orientation.

| Movable   |   |   |   | Fixed   |  |   |   |
|---|---|---|---|---|--|---|---|
| symmetrical   | rightward   | leftward  |   | symmetrical   | rightward  | leftward  |   |
|  |  |  |  |  |  |  |  |

Table 3: An example of the four combinations of object and arrow.

|   |   |   |   |   |  |   |   |
|---|---|---|---|---|--|---|---|
|  |  |  |  |  |  |  |  |
| Picture code  | $\rightarrow Obj$   | $\geq Obj$  |   | $Obj \rightarrow$   |  | $Obj \geq$  |   |

## Procedure

The combinations of objects and arrows were organized in a Latin Squares Design resulting in eight different orders of presentation. Table 4 shows the three phases in which tasks have been administered. First participants gave a spontaneous interpretation of the pictures. Then they had to decide (yes/no) for each picture the adequacy of five descriptions (two referential, three attributive; two addressee oriented, three not, see Table 4). Finally they received for each object four pictures (as in Table 3), and had to decide by forced choice which of the four fitted a given description best.

Table 4: The three experimental tasks.

| Spontaneous reaction  | Yes/no decision   | Forced choice   |
|---|---|---|
| Complete the following sentence: <i>This picture displays .....</i> | Decide for this specific picture whether each of the following five descriptions applies: <i>this is X; look at X; X is coming from the left; X is going to the right; move X</i> | Decide for these four pictures which fits best the following description: <i>each instance was followed by one of the five descriptions mentioned under =yes/no decision=</i> |

## Participants

128 persons took part in the experiment, 64 male, 64 female. Age was on average 39.1 (sd 13.21) and ranged from 18 to 68. Participants were classified with respect to four personal characteristics: Age (under 40 49%, over 40 51%), Educational level (low 26%, medium 31%, high 43%), Need for Cognition (low 28%, medium 38%, high 34%), and Processing Type (verbalizer 46%, visualizer 54%).

## Results

Table 5 shows the proportion of adequate spontaneous descriptions produced in task 1 in relation with personal characteristics. Overall, 70 percent of the answers were adequate descriptions of the pictures: they offered either a referential or an attributive interpretation with or without explicitly mentioning the addressee. A description was coded as inadequate when only the object had been mentioned (*garden*

*gnome, this bicycle, edge of ball*), or when arrow and object were simply juxtaposed (*flower pot with arrow, wigwam and arrow together, lamp next to arrow*). With each personal characteristic the scores displayed a plausible pattern, e.g., score went up with an increase in Need for Cognition. Differences were statistically significant for Gender ( $F(1,978)=7.30$ ,  $p<.01$ ), Educational Level ( $F(2,978)=7.82$ ,  $p<.001$ ), Need for Cognition ( $F(2,978)=4.99$ ,  $p<.01$ ), and Processing Type ( $F(1,978)= 5.21$ ,  $p<.025$ ; Age:  $F(1,978)=1.35$ ,  $p=.25$ ). Objects differed from each other with respect to Movability: movable objects scored higher on adequate descriptions than fixed ones (73% versus 67%;  $F(1,127)= 10.55$ ,  $p<.001$ ; Orientation:  $F<1$ ). Properties of the arrow had no effects (Position:  $F<1$ ; Direction:  $F<1$ ; Colour:  $F<1$ ).

Table 5: Adequate descriptions in relation with personal characteristics (in percentages)

| Gender |        | Age |     | Educational Level |        |      | Need for Cognition |        |      | Processing Type |            |
|--------|--------|-----|-----|-------------------|--------|------|--------------------|--------|------|-----------------|------------|
| male   | female | <40 | ≥40 | low               | medium | high | low                | medium | high | verbalizer      | visualizer |
| 65     | 73     | 71  | 67  | 60                | 74     | 73   | 66                 | 66     | 76   | 66              | 72         |

The left hand panel in Table 6 shows that for all pictures the five descriptions were considered adequate by 30 to 70 percent of the participants. Even intuitively highly improbable cases scored over 30 percent, (e.g., *this is a wigwam* for the second picture in Table 3). The right hand panel shows for a forced choice a much clearer pattern. The two referential descriptions (*this is, look at*) were associated more with arrows pointing toward the object, fitting in with the deictic function of the arrow. The attributive descriptions (*move; comes from/goes to* taken together in Table 6) were associated more with arrows pointing away from the object.

Table 6: Within both tasks for each picture the perceived adequacy of the descriptions (in percentages; most plausible picture-description combinations are shaded)

|   | Yes/no decision |       |       |      | Forced Choice |       |       |      |
|---|-----------------|-------|-------|------|---------------|-------|-------|------|
|   | →Obj            | Obj ≥ | Obj → | ≥Obj | →Obj          | Obj ≥ | Obj → | ≥Obj |
| this is Obj                             | 69              | 69    | 34    | 35   | 64            | 35    | 1     | 0    |
| look at Obj                             | 70              | 67    | 33    | 31   | 63            | 35    | 2     | 0    |
| Obj comes from left resp. goes to right | 48              | 41    | 48    | 47   | 27            | 5     | 64    | 4    |
| move Obj                                | 31              | 26    | 45    | 42   | 19            | 8     | 48    | 25   |

## Discussion

Participants spontaneously produced adequate descriptions for object-arrow pictures in 70 percent of the cases. Four out of five personal characteristics and the movability of the object had a noticeable effect; features of the arrow played no role. In all cases, when an interpretation was adequate, it was still far from univocal: to the same picture participants gave both referential and attributive readings. When deciding on the adequacy of descriptions in a yes/no decision task, results were remarkable: highly probable interpretations never scored over 70 percent, highly improbable ones scored no less than 30 percent. Only when a forced choice had to be made, more or less unique combinations of a picture and its interpretations became apparent.

## References

- Cutting, J. (2002). Representing motion in a static image: constraints and parallels in art, science, and popular culture. *Perception*, 31, 1165-1193.
- Donnellan, K. (1966). Reference and definite descriptions. *Philosophical Review*, 75, 281-304.
- Hoogwegt, H., Maes, A., & Wijk, C. van (2009). Suggesting motion in health communication pictures; The effect of pictorial and extra pictorial manipulation. *Communicatio*, 35, 276-294.