

# Arrows for the Communication of Spatio-temporal Knowledge: Semantics and Interpretation

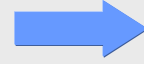


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Did you use arrows?



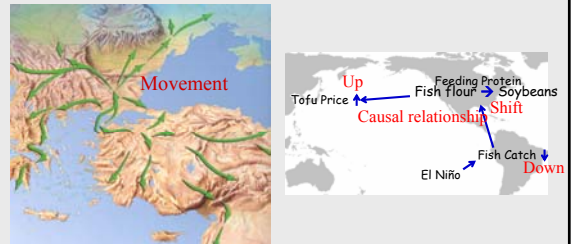
Why?

## Why Do People Use Arrows?

- People like diagrams.
- Arrows illustrate a large variety of semantics.
- Arrows are simple.
- Arrows make it possible to communicate spatio-temporal knowledge in a *static* diagram.

## Power of Arrows

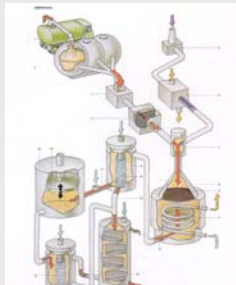
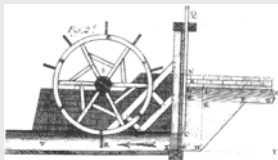
- Maps



A geographic process can be illustrated in a static map.

## Power of Arrows

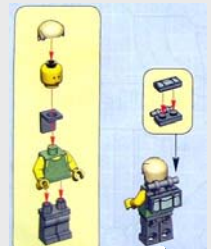
- Mechanical drawings



Arrows facilitate the understanding of a dynamic mechanism.

## Power of Arrows

- Manuals & Instructions



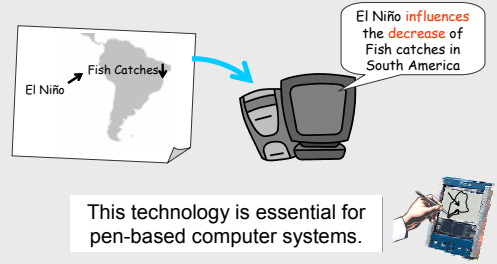
Arrows make it easy to explain a spatial task.

## Power of Arrows

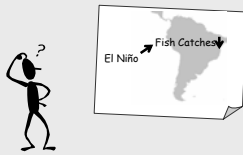
- Summary
  - Arrows make it possible to communicate spatio-temporal knowledge in a static diagram.

## Our Project

- To develop a computational method for interpreting arrow-containing diagrams.



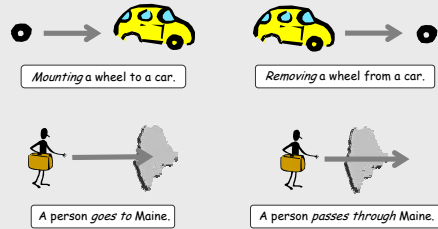
## How Do We Interpret Arrows?



What clues are available from the diagrams?

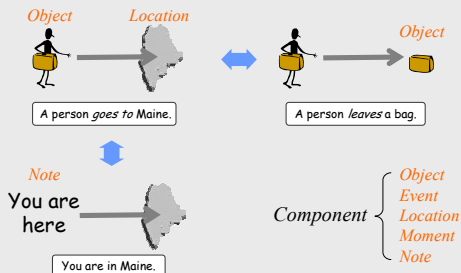
## How Do We Interpret Arrows?

- Clue 1: component alignment



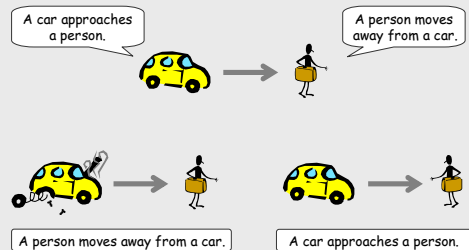
## How Do We Interpret Arrows?

- Clue 2: component type



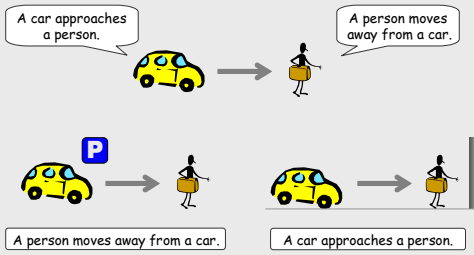
## How Do We Interpret Arrows?

- Clue 3: mobility and movable direction



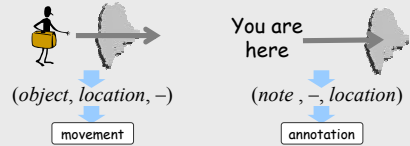
## How Do We Interpret Arrows?

- Clue 4: background space



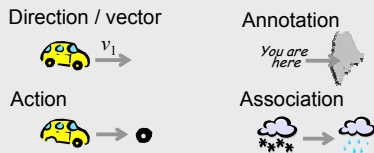
## Our Approach

- Properties that contribute to interpretations:
  - Component alignment
  - Component types
  - Mobility and movable direction of components
  - Background space
- Syntactic patterns of arrows are formalized.



## Our Approach

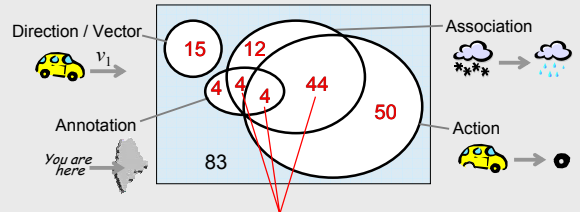
- Arrow-related semantics are classified into:



- Syntactic rules for illustrating each class of semantics using an arrow are investigated.

## Result

- Correspondence between syntactic patterns and semantics of arrows



Multiple candidates of interpretation  
→ How to narrow down?

## Conclusions

- Arrows are powerful representation tool, with which people can communicate spatio-temporal knowledge in a static diagram.
- The following four properties contribute to the interpretation of arrows.
  - Component alignment
  - Component types
  - Mobility and moving direction of components
  - Background space

## Questions ?



or more arrows?