Generic semantic frames and frame elements in *AirFrame*

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INTRODUCTION

Within the installation research project *Dynamicity of Specialized Knowledge Categories* (DIKA, ihjj.hr/dika), financed by the Croatian Science Foundation, a lexical database is being created in which terms from the field of aviation are defined in semantic frames with relevant frame elements and conceptual relations. The ***AirFrame* database** is being designed following the methodology of description of semantic frames, frame elements and lexical elements in the lexical database FrameNet. Data categories and their relations have been defined by taking into account the specific aspects of the domain of aviation.

The database is going to be organized around several key semantic frames in aviation: **Flight**, **Airplane**, **Airspace**, **Airport**, **Air traffic** and **Air traffic control**. Each frame consists of frame definitions, core and non-core frame elements (FEs) or semantic roles, frame to frame relations and other semantic information.

METHODOLOGY

In order to make the description of frames as uniform as possible, generic semantic frames or frame templates have been created, using top-level categories or upper level ontologies as the starting point. The following steps have been taken:

1. compare and analyze several upper level ontologies
2. define the top-level categories most relevant for aviation
3. create the classification of top-level categories used in the description of aviation semantic frames
4. define the key semantic frames in aviation
5. define the generic semantic frames used for the description of all frames in the field of aviation.

TOP-LEVEL CATEGORIES

Three upper level ontologies – WordNet, SUMO ontology and GOLD ontology – have been analyzed in order to create a classification of basic top-level categories relevant for aviation. The category of **Entity** is the basic category in the organization of all knowledge, and it can be divided into two broad groups: **Physical_entity** and **Abstract_entity**.

physical entity
- object
  - whole, unit
  - location
  - part, portion
- causal agent
- matter
- physical process
  - phenomenon
  - human process
  - natural process
  - operation, functioning, performance
  - organic process

abstract entity
- psychological feature
  - knowledge
    - cognitive process
    - unconscious process
    - perception
  - motivation
  - event
    - act
    - natural event
- attribute
  - state
  - shape
  - time
  - infinite space
  - trait
  - quality
  - property
- relation
  - possession
  - social relation
  - spatial relation
  - causality
  - function
  - connectedness
  - component
  - control
  - temporal relation
  - comparison
  - opposition
  - change
- communication
- amount

Figure 1. Physical and abstract entities in the upper level ontology defined within the project.

The category of Abstract_entity is a complex category that is in WordNet divided into 8 hyponyms, but only the following are relevant for aviation: Psychological_feature, Attribute, Relation, Communication and Amount. Some of these categories have a large number of hyponyms, such as relation and attribute. However, they appear to be of different complexity and relevance, therefore only the most important ones are chosen, e.g. Spatial_relations, Temporal_relations, Causality, Possession, etc.

The definition of specialized knowledge starts from defining universal categories and finding your way to domain specific types of knowledge categories, taking into account the influence of culture which is manifested in mid-level and domain specific categories. The diagram shows the immediate or inherited relations between the categories of e.g. Vehicle and Airplane, or Location and Airspace. The dotted lines show other relations, e.g. *uses* between Airplane and Airspace or *is causative of* between Pilot and Airplane.

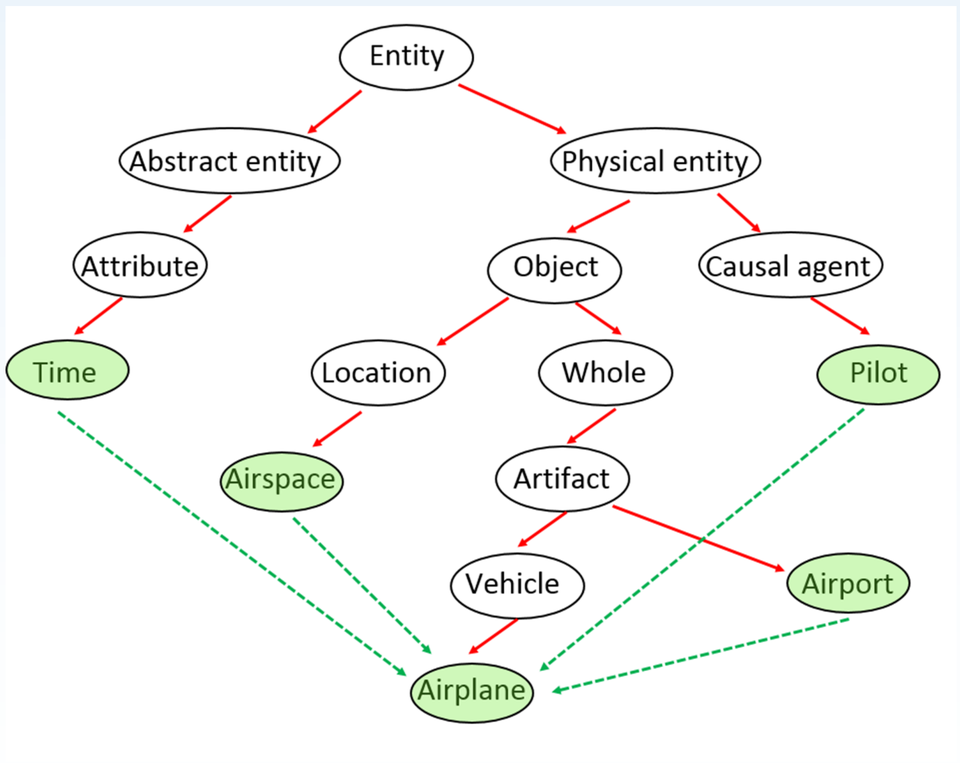

Figure 2. Diagram of the relations between top-level and domain specific categories in aviation.

SEMANTIC FRAMES OF AVIATION

Each of the six key aviation frames is a complex semantic frame consisting of subframes that act as individual frames connected with conceptual, frame-frame relations indicating generic, partitive or other relations: ***uses***, ***is used by***, ***precedes***, ***is preceded by***, ***is causative of***, ***is inherited by***, etc.

Flight
definition: The movement of **Aircraft** from a departure **Aerodrome** to a destination Aerodrome.

Core FEs:

Aircraft A powered heavier-than-air **Vehicle** capable of **Flying** by gaining support from the **Air**.
Semantic type: Instrument

Airspace Three-dimensional portion of the **Atmosphere** controlled by a **Country** above its **Territory**.
Semantic type: Location

Aerodynamic_force
The **Force** exerted on a **Body** by the **Air** in which the **Body** is **Moving**.
Semantic type: Natural_process

Flying The **Process** of **Moving** through **Air**.
Semantic type: Process

Non-core FEs:

Pilot A **Person** who is trained to **Fly** an **Aircraft**.
Semantic type: Agent

Aerodrome A **Location** from which **Aircraft** **Flight** operations take place.
Semantic type: Location

Passengers A **Person** who is **Travelling** in a **Vehicle**.
Semantic type: Patient

Figure 3. Core and non-core frame elements in the semantic frame Flight

Templates for defining all aviation related semantic frames have been created based on types of knowledge categories appearing in aviation and the conceptual relations that bind them in complex networks. Each frame consists of a definition more detailed than a prototypical terminological definition. Definition help to recognize the related superordinate frame as well as core and non-core frame elements.

Frame

definition:
superordinate concept + delimiting characteristics + other relevant characteristics

frame-frame relation — *inherits from*
core frame elements
non-core frame elements

Entity
- Physical_entity
  - Object
    - Origin
    - Properties
    - Location
    - Type
    - Use
  - Causal_agent
    - Origin (person or nature)
    - Location
    - Purpose
    - Means
- Abstract_entity
  - Attribute
    - State
    - Quality
  - Relation
    - Possession
    - Social_relation
    - Function
    - Temporal_relation

Process

Human process	Operation	Natural process
Agent / Causal_agent	Agent	Causal_agent / Formational_cause
Duration	Duration	Duration
Location	Location	Location
Manner	Means	Manner
Circumstances	Purpose	Circumstances
Result	Result	Result

Figure 4. Diagram of generic frames and their elements

CONCLUSIONS

Developing a complex lexical database requires a uniform approach to the definition of data, esp. with many people working on the data entry. The *AirFrame* terminological database aims at providing both semantic and syntactic description of aviation terminology, as well as offering a possibility of interchange with lexical databases of general language. Therefore the templates of semantic frames are developed in order to allow for consistent terminological work and easier terminology management. The module for syntactic and semantic annotation of chosen terminological contexts is being developed, which will add to the database value and terminology research in general.

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