PROMOTING THE SCIENTIFIC EXPLORATION OF COMPUTATIONAL CREATIVITY

Computational Approaches to Conceptual Blending (part II)

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PROSECCO

CISUC

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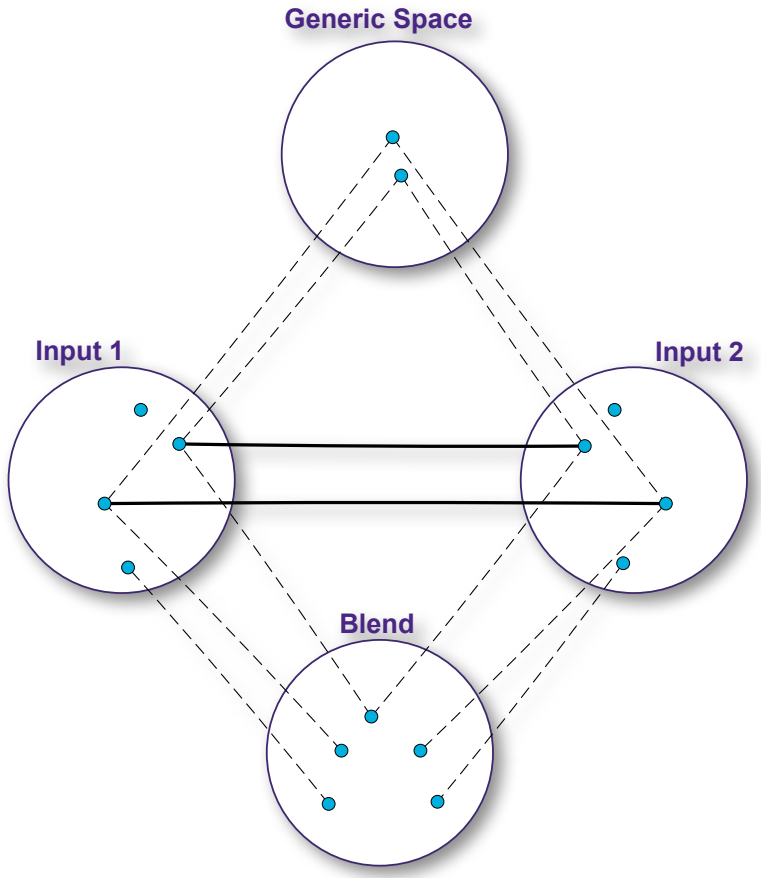
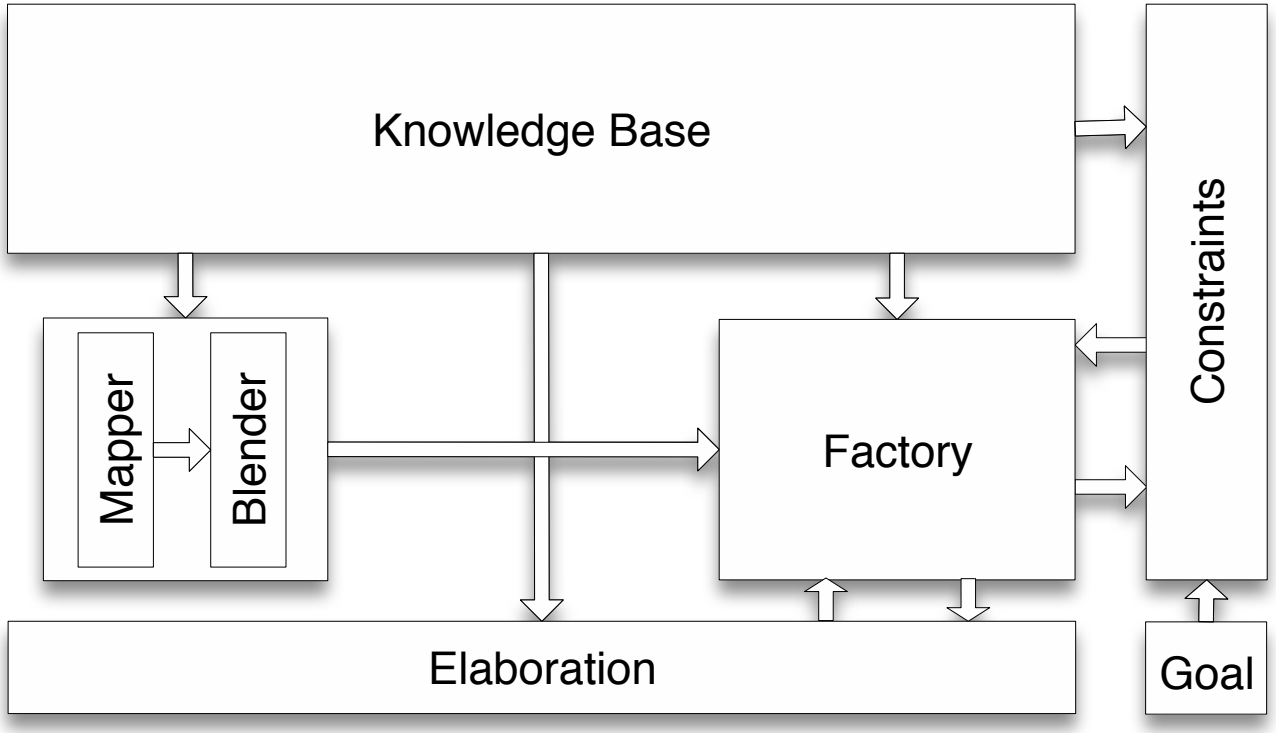
Divago

- Given:
  - Two input Domains (Mental Spaces)
  - One Generic Space Domain
- Produces:
  - Blend Domain

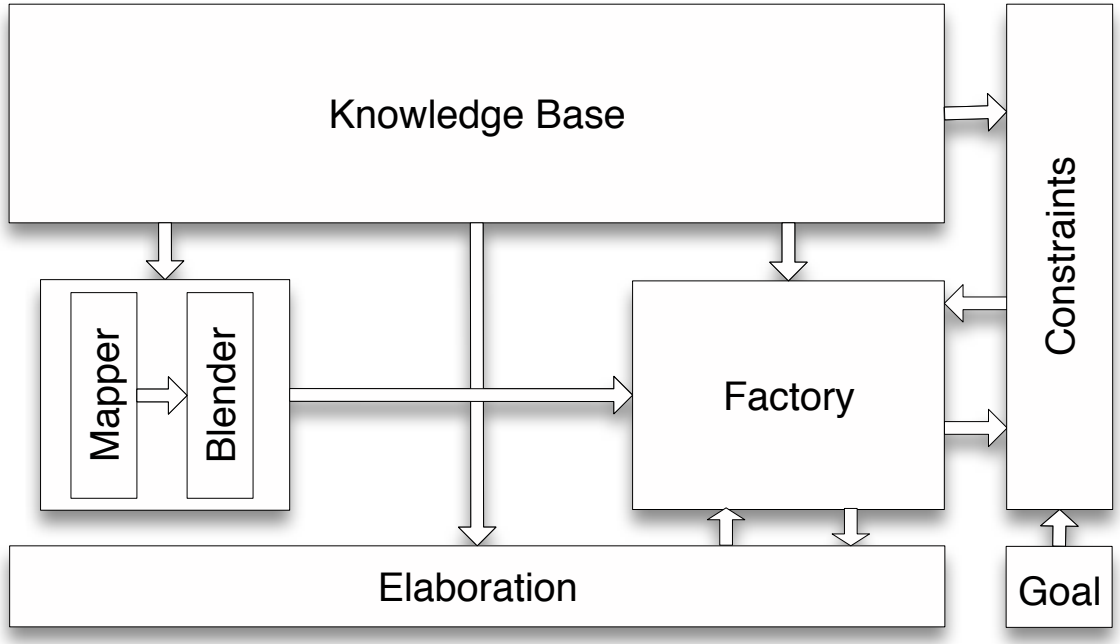


Divago Architecture



Knowledge Base

- Composed by *Domains*
- Domain:
  - Concept Map
  - set of Instances
  - set of Rules
  - set of Frames
  - set of Integrity Constraints



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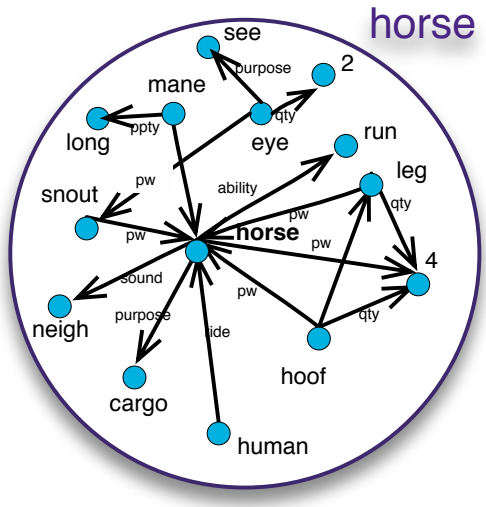

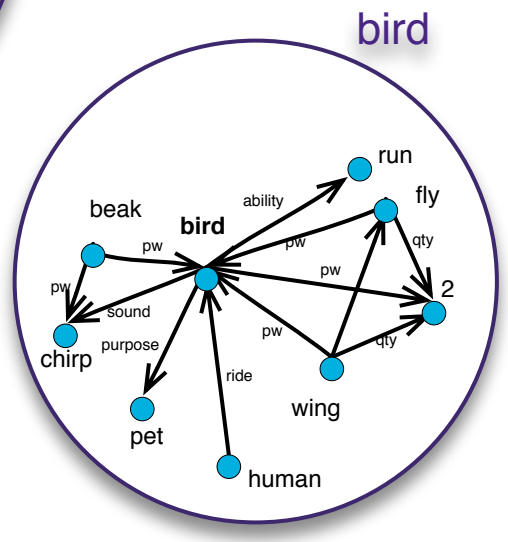

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$$frame(transport\_means(X)):$$

$$carrier(X, people) \longleftarrow have(X, container) \wedge have(X, Y) \wedge purpose(Y, locomotion) \wedge drive(\_, X)$$

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$$
\begin{aligned}
&frame(new\_ability(d1)):\\
&\quad new\_ability(X,A) \longleftarrow ability(X,A) \wedge not\ rel(d1, ability(X,A)) \wedge\\
&\qquad purpose(P,A) \wedge pw(P,X) \wedge\\
&\qquad projection(blend, d1, X, X) \wedge\\
&\qquad projection(blend, d2, A, A)
\end{aligned}
$$

Transforming Frame

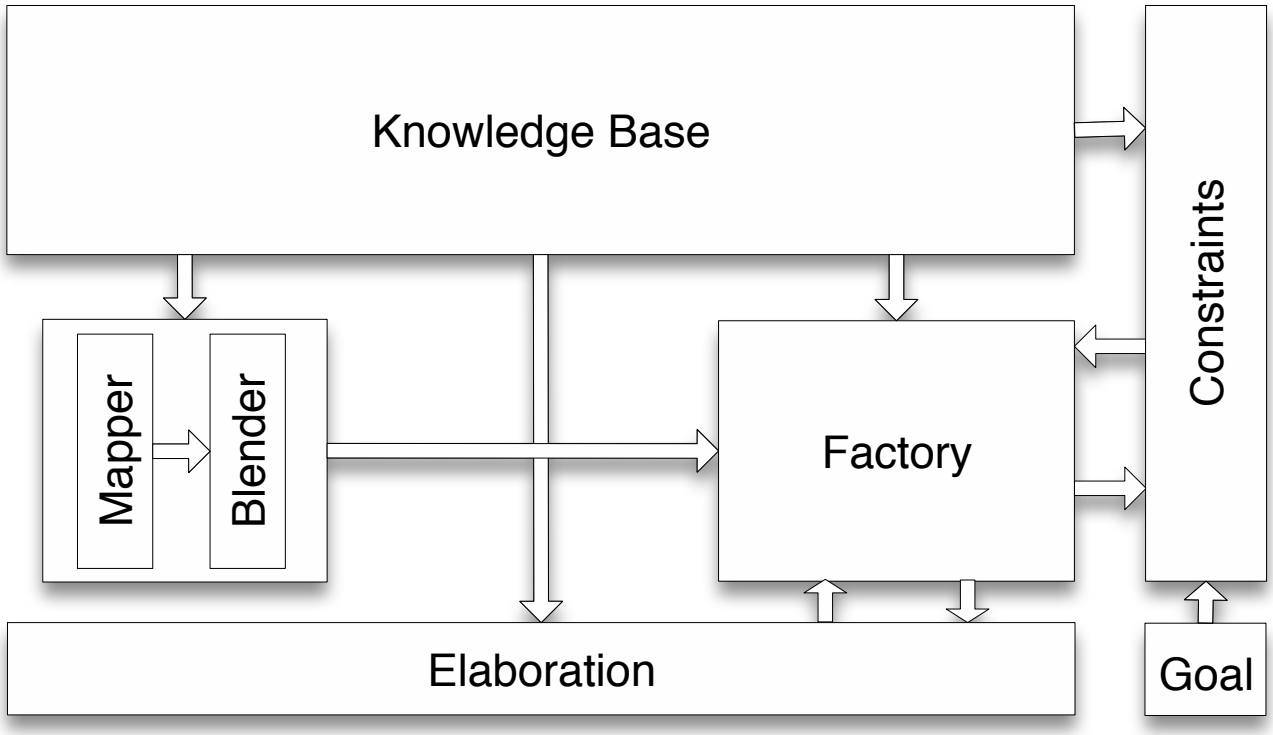
Knowledge Base

- Composed by *Domains*
- Domain:
  - Concept Map
  - set of Instances
  - set of Rules
  - set of Frames
  - **set of Integrity Constraints**

$$false \leftarrow state(X, dead) \wedge state(X, alive)$$

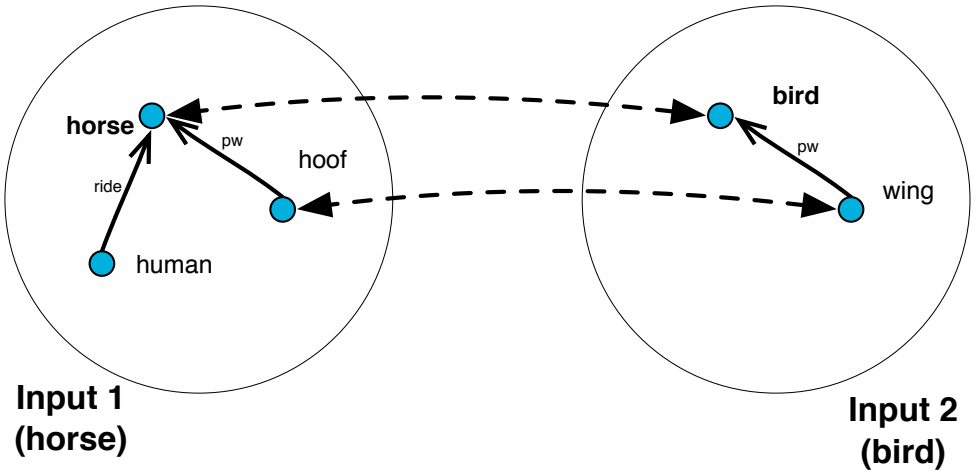
$$false \leftarrow pw(X, X)$$

Mapping Engine



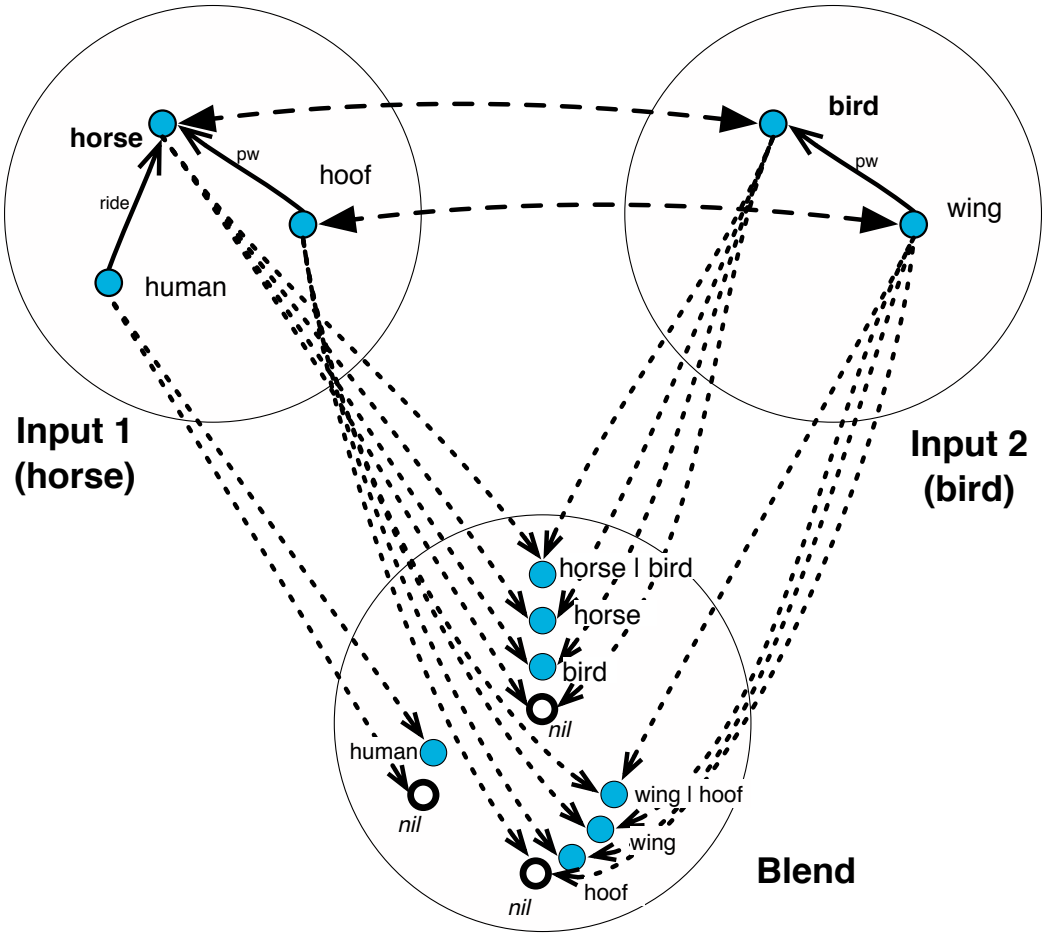
Mapping Engine

- Structure alignment + Spreading activation
  - Similar to Sapper [Veale 93], but simpler
- Mapping: largest isomorphic pair of subgraphs
- Returns set of all possible mappings



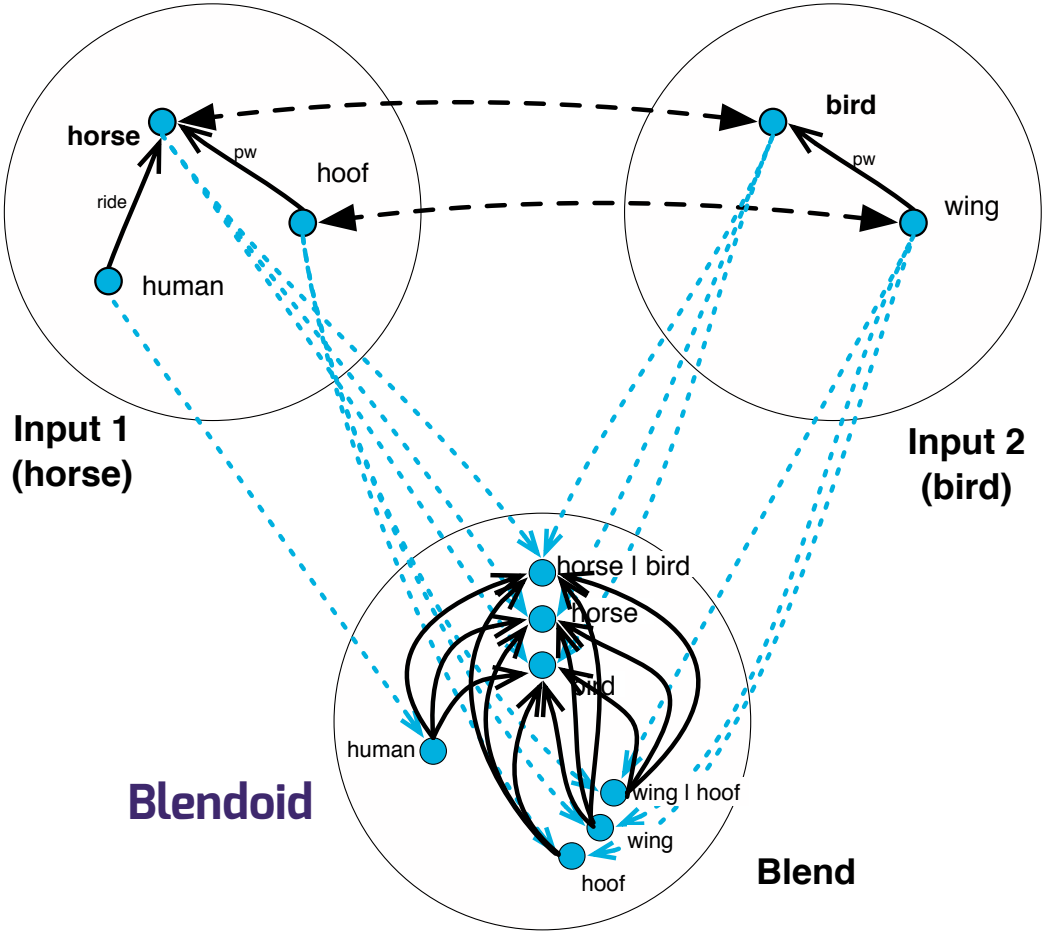
Blender

- For each mapping m, makes a blending projection

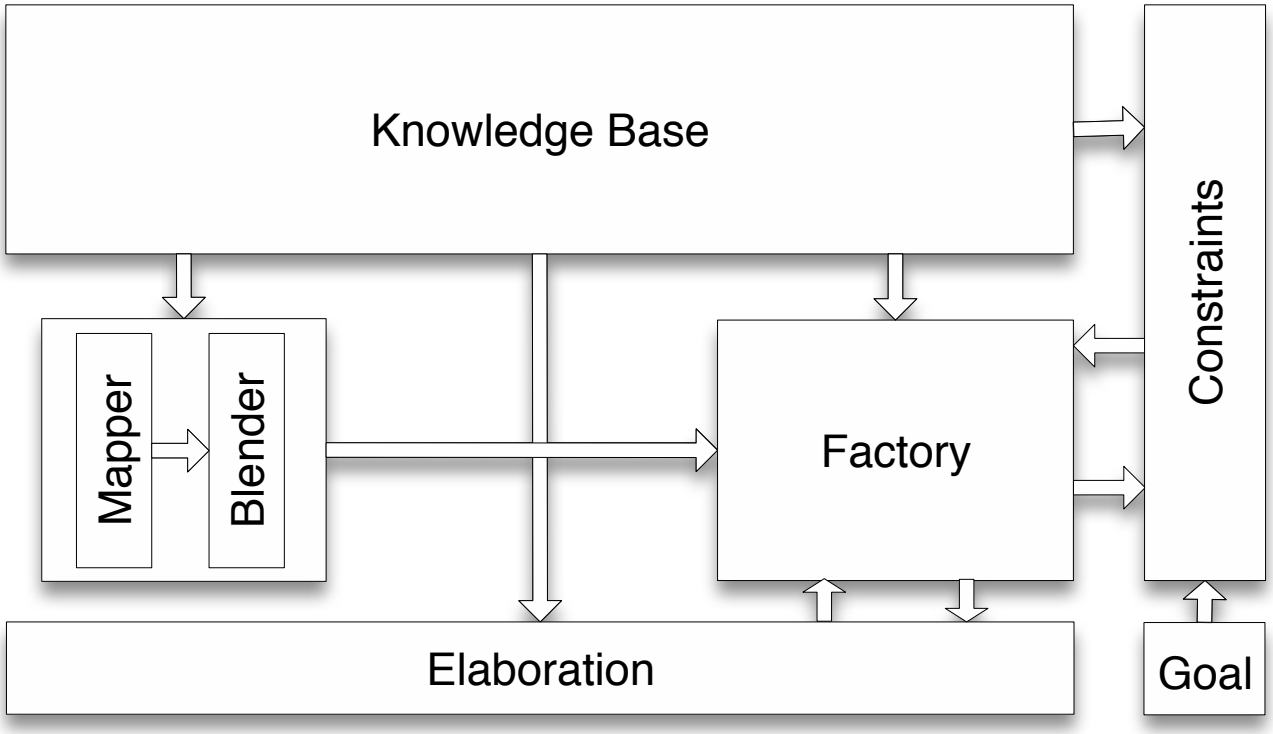


Blender

- For each mapping m, makes a blending projection
- Then, projects remaining elements in the Blend

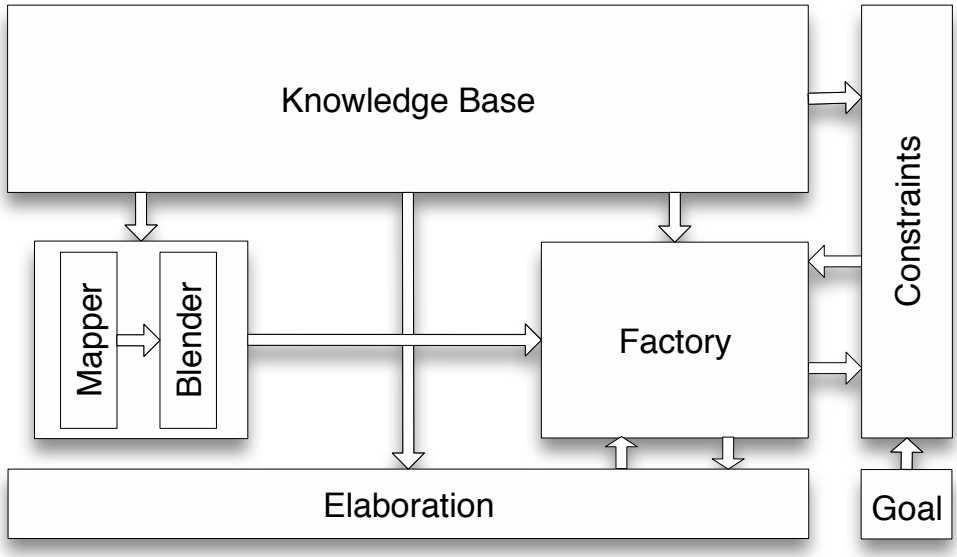


Factory


Knowledge Base
Constraints
Mapper
Blender
Factory
Elaboration
Goal

Factory

- Explores the space of all possible combinations of projections
- Divergent Strategy: GA
- Convergent Strategy
- Stoping condition



Factory

- Evolve projections:
  - individual = set of projections for each node of input domains
  - Paralell search for best blend
- Compute Blend:
  - for each individual
- Fitness function:
  - weighted sum of optimality constraints
    - 8 optimality principles (from F&T 2002)

Optimality Constraints (F&T 2002)

- Integration
- Topology
- Maximization of Vital Relations
- Unpacking
- Relevance
- Web
- Pattern Completion
- Intensification of Vital Relations

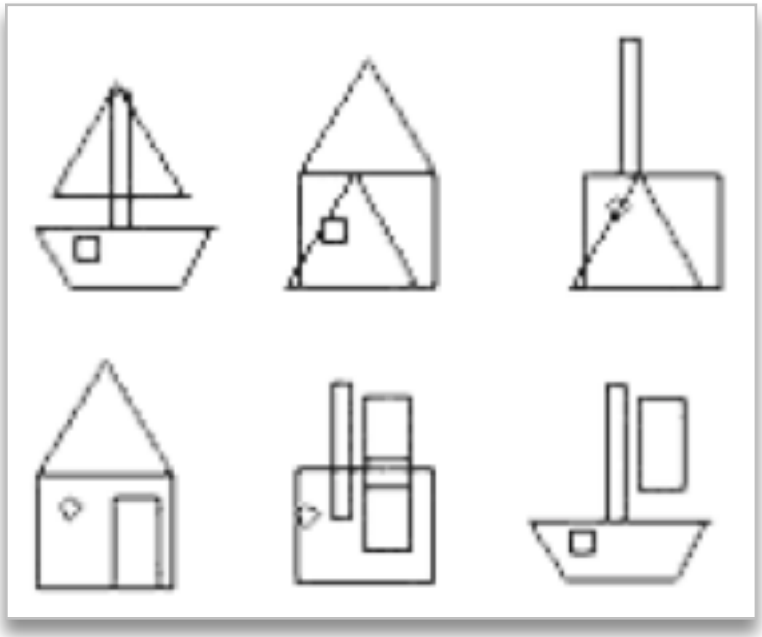
Elaboration

- Completion + Elaboration
- Run Frames, run rules

Boat-House experiment

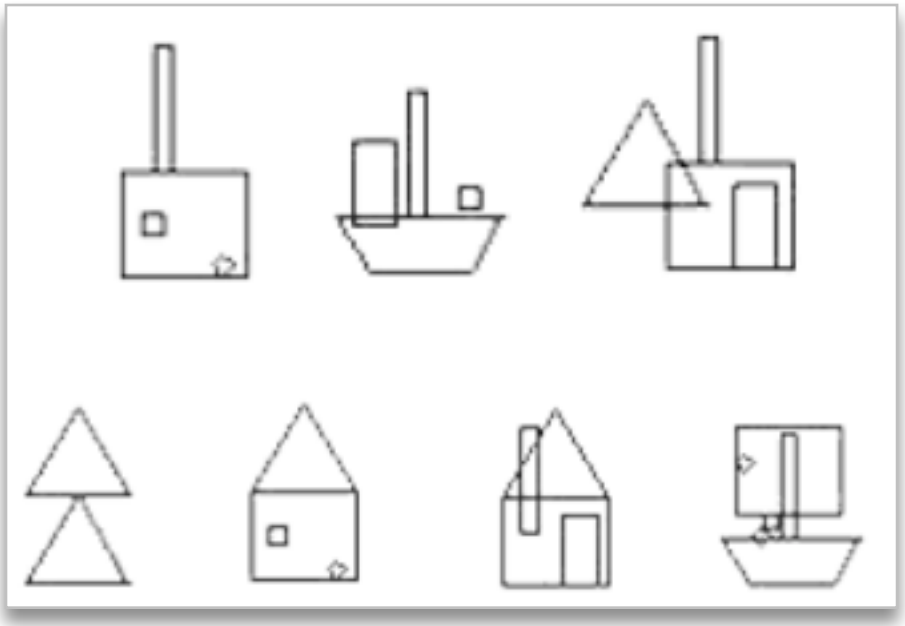
- Only Concept Maps + Instances

entrance	↔	movement
task	↔	task
protection	↔	support
roof	↔	mast
door	↔	sail
house	↔	sailing_boat
physical_ structure	↔	boat
window	↔	hatch
body	↔	vessel
water_proof	↔	slow
container	↔	container
observation	↔	observation



Boat-House experiment

body	↔	sail
container	↔	movement
door	↔	hatch
entrance	↔	observation
house	↔	sailing_boat
physical_ structure	↔	boat
window	↔	mast
roof	↔	vessel
water_proof	↔	slow
protection	↔	container
observation	↔	support



Creatures experiment

- Input creatures

Creatures experiment - outputs

- horse|dragon (nov=0.25), horse|werewolf (0.56) and werewolf|dragon (0.62)

Creatures experiment - outputs

- horse|dragon (0.37), horse|werewolf (0.86) and werewolf|dragon (0.65)

Recent approaches

- Li, B., Zook, A., Davis, N., and Riedl, M. (2012). Goal-Driven Conceptual Blending: A Computational Approach for Creativity (ICCC12)
  - address the efficiency issues by constructing blends in a goal-driven and context-driven manner.
- Veale, T. (2012). From Conceptual "Mash-ups" to "Bad-ass" Blends: A Robust Computational Model of Conceptual Blending. (ICCC12)
  - constrained notion of Blend for creative reuse and extend existing common-sense knowledge of a topic