

Analyzing verb polysemy in frames

A case study of German *steigen* ‘rise/climb’

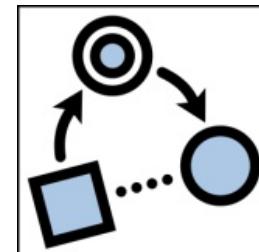
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Major uses of the German movement verb *steigen* 'climb, rise, step'

The German verb *steigen* can be used as a:

1. verb of manner of motion
2. verb of directed motion
3. figurative verb of change

Objectives

- investigate the "anatomy" of the different uses and the relationship between these uses

Objectives

- investigate the "anatomy" of the different uses and the relationship between these uses
- develop an analysis in terms of frames

Polysemy of *steigen* 'climb, rise': *steigen* as a verb of manner of motion

1. *steigen*_{manner}:

Hans steigt auf einen Berg.

H. climbs on a mountain

'Hans is climbing a mountain.'



Polysemy of *steigen* 'climb, rise': *steigen* as a verb of directed motion

2. *steigen*_{directional}:

Der Ballon steigt.

the balloon climbs

'The balloon is climbing.'



Polysemy of *steigen* 'climb, rise': *steigen* as a figurative verb of change

3. *steigen*_{figurative}:

Die Temperatur der Flüssigkeit steigt.

the temperature of the liquid rises

'The temperature of the liquid is rising.'



Manner of motion vs. direction of motion

*steigen*_{manner} → use of legs/feet,
ground contact

- a. ✓ ***Die Ziegen steigen aufs Dach.***
the goats climb onto.the roof

'The goats are climbing onto the roof.'



Manner of motion vs. direction of motion

*steigen*_{manner} → use of legs/feet,
ground contact

- b. ??***Die Schnecke steigt auf die Pflanze.***
the snail climbs onto the plant
'The snail is climbing onto the plant.'



Manner of motion vs. direction of motion

*steigen*_{manner} → use of legs/feet,
ground contact

- c. ?? ***Der Zug steigt auf den Berg.***
the train climbs onto the mountain
'The train is climbing the mountain.'



Manner of motion vs. direction of motion

Geuder & Weisgerber (2008):

*steigen*_{manner} can be instantiated by a single step

Sie stieg über die Pfütze.

she stepped over the puddle

'She stepped over the puddle.'



Manner of motion vs. direction of motion

*steigen*_{directional} → freely suspended object,
no reference to extremities

- a. *Der Ballon stieg höher und höher.*
the balloon climbed higher and higher
'The balloon climbed higher and higher.'



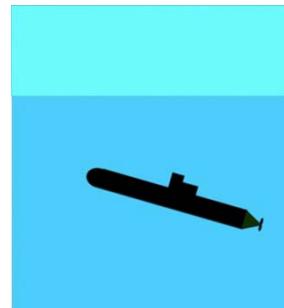
Manner of motion vs. direction of motion

*steigen*_{directional} → freely suspended object,
no reference to extremities

- a. *Der Ballon stieg höher und höher.*
the balloon climbed higher and higher
'The balloon climbed higher and higher.'



- b. *Das U-Boot stieg an die Oberfläche.*
the submarine climbed to the surface
'The submarine climbed towards the surface.'



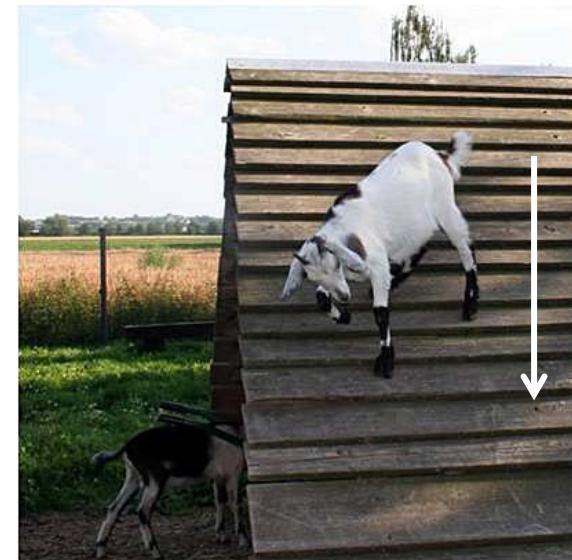
Manner of motion vs. direction of motion

*steigen*_{manner}: combination with all kinds of directionals

a. *Die Ziegen stiegen vom Dach.*

the goats climbed from.the roof

'The goats climbed (down) from the roof.'



Manner of motion vs. direction of motion

*steigen*_{directional}: only upward direction

- b. **Der Ballon stieg tiefer und tiefer.*
the balloon climbed deeper and deeper
lit.: *'The balloon climbed deeper and deeper.'



Manner of motion vs. direction of motion

*steigen*_{manner}: directional complement necessary

- a. *Hans *stieg* den ganzen Tag.
H. climbed the whole day
lit.: 'Hans climbed the whole day long.'

*steigen*_{directional}: directional complement optional

- b. ✓*Der Ballon stieg.*
the balloon climbed
'The balloon was climbing.'

Manner of motion vs. direction of motion

*steigen*_{manner}

- use of legs/feet
- ground contact
- all directions
- dir-comp. obligatory

*steigen*_{directional}

- no reference to limbs
- freely suspended
- only upwards
- dir-comp. optional

Manner of motion vs. direction of motion

⇒ Geuder & Weisgerber (2008):

The manner component of German *steigen* is more specific than that of the English verb *climb* (cf. the discussion of *climb* by Fillmore (1982), Jackendoff (1985) and Levin & Rappaport (2013) among others)

Manner of motion vs. direction of motion

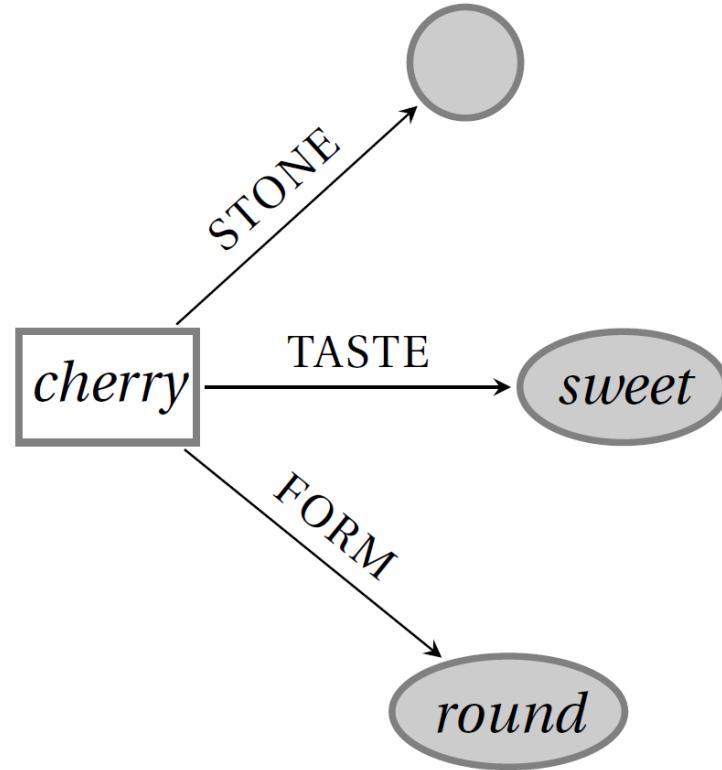
- ⇒ Gamerschlag, Geuder & Petersen (2014):
There are 2 clearly distinguished variants of
steigen referring to movement in space
- The restriction of directional *steigen* to upward movement can perhaps be motivated from a stereotype of upward movement associated with the manner use of *steigen* (cf. Levin & Rappaport).

Analysis: Framework

- Conceptual knowledge is captured in frame representations.
- Frame representations provide an explicit, variable-free, and cognitively plausible format.
- Frames are defined as recursive attribute-value structures (Barsalou 1992).
- The attributes correspond to mathematical functions.

Frames for nominal concepts

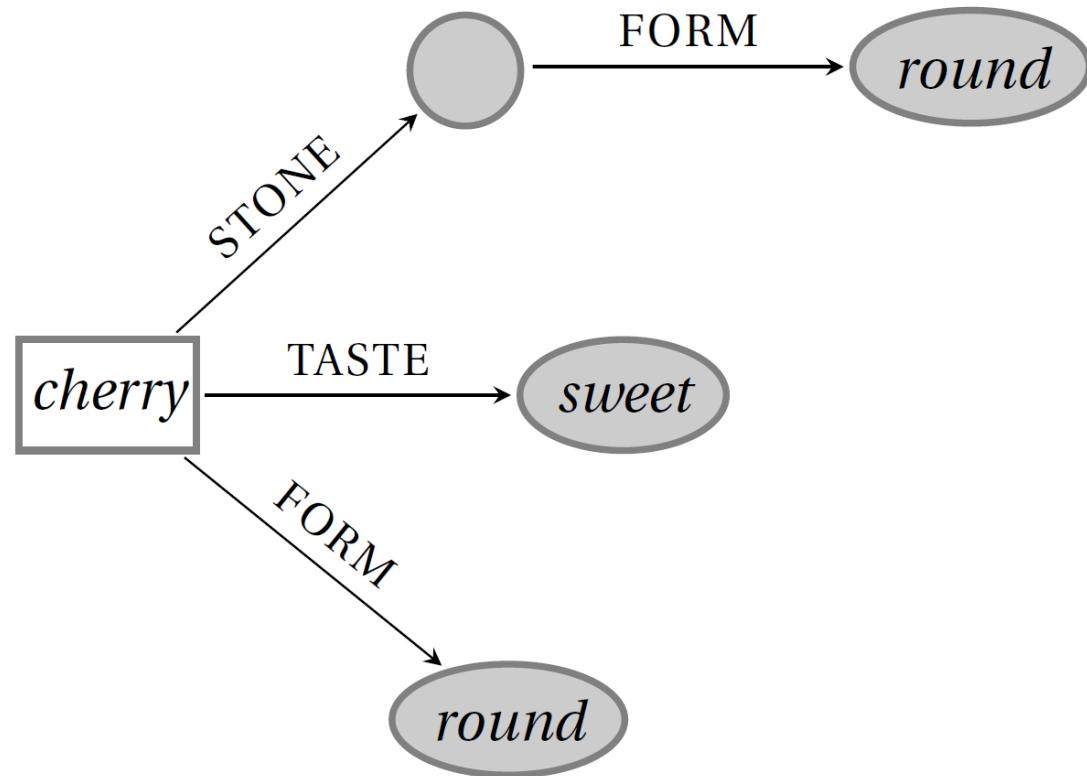
(Petersen 2007, Petersen & Osswald 2014)



frame representation of sortal concept 'cherry'

Frames for nominal concepts

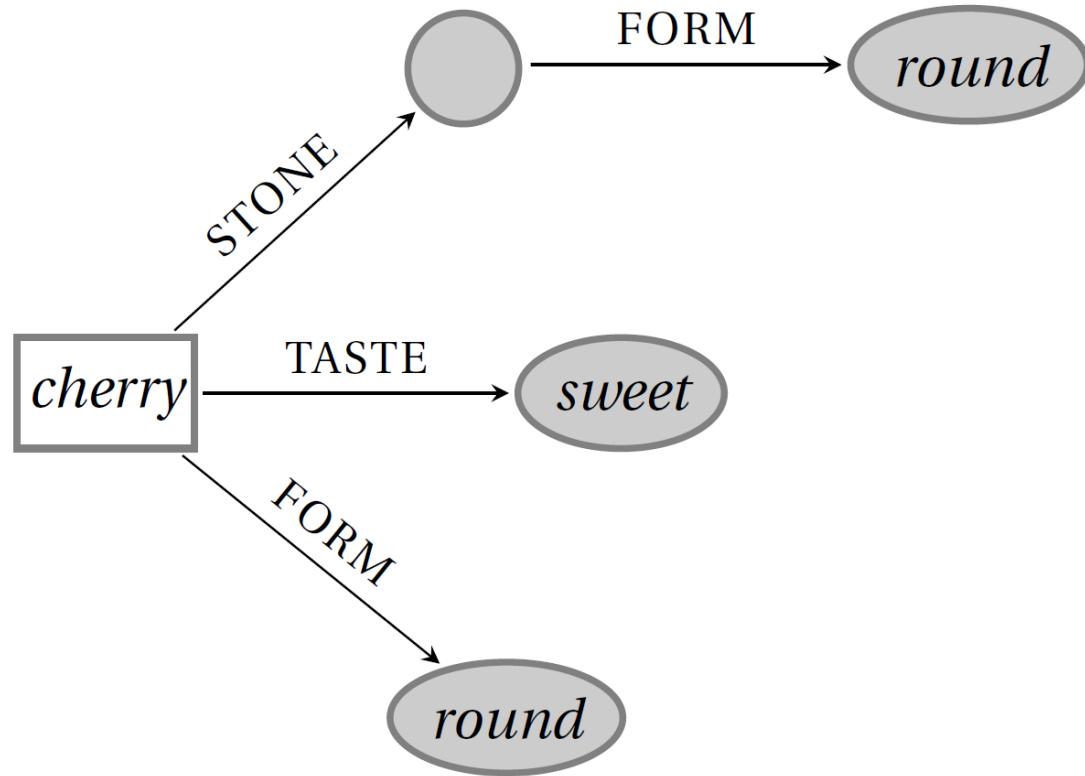
(Petersen 2007, Petersen & Osswald 2014)



frame representation of sortal concept 'cherry'

Frames for nominal concepts

(Petersen 2007, Petersen & Osswald 2014)

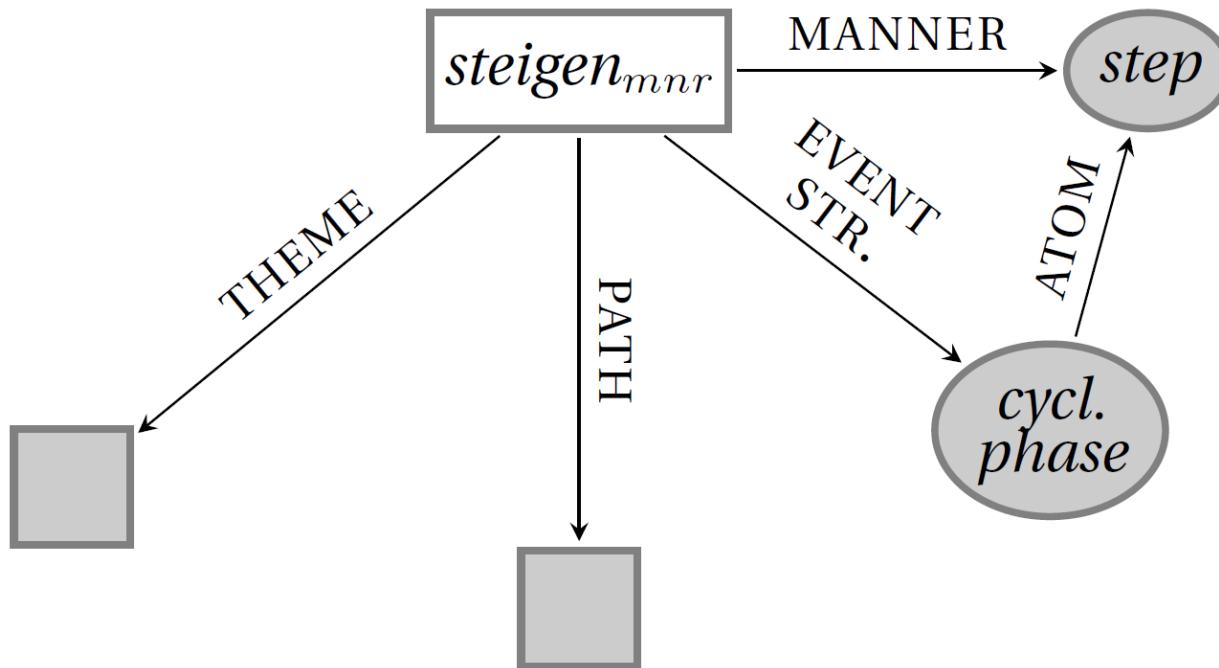


frame representation of sortal concept 'cherry'

'cherry': $\lambda x. \text{cherry}(x) \wedge \text{round}(\text{FORM}(\text{STONE}(x))) \wedge \text{sweet}(\text{TASTE}(x)) \wedge \text{round}(\text{FORM}(x))$

Frame analysis of *steigen*_{manner}

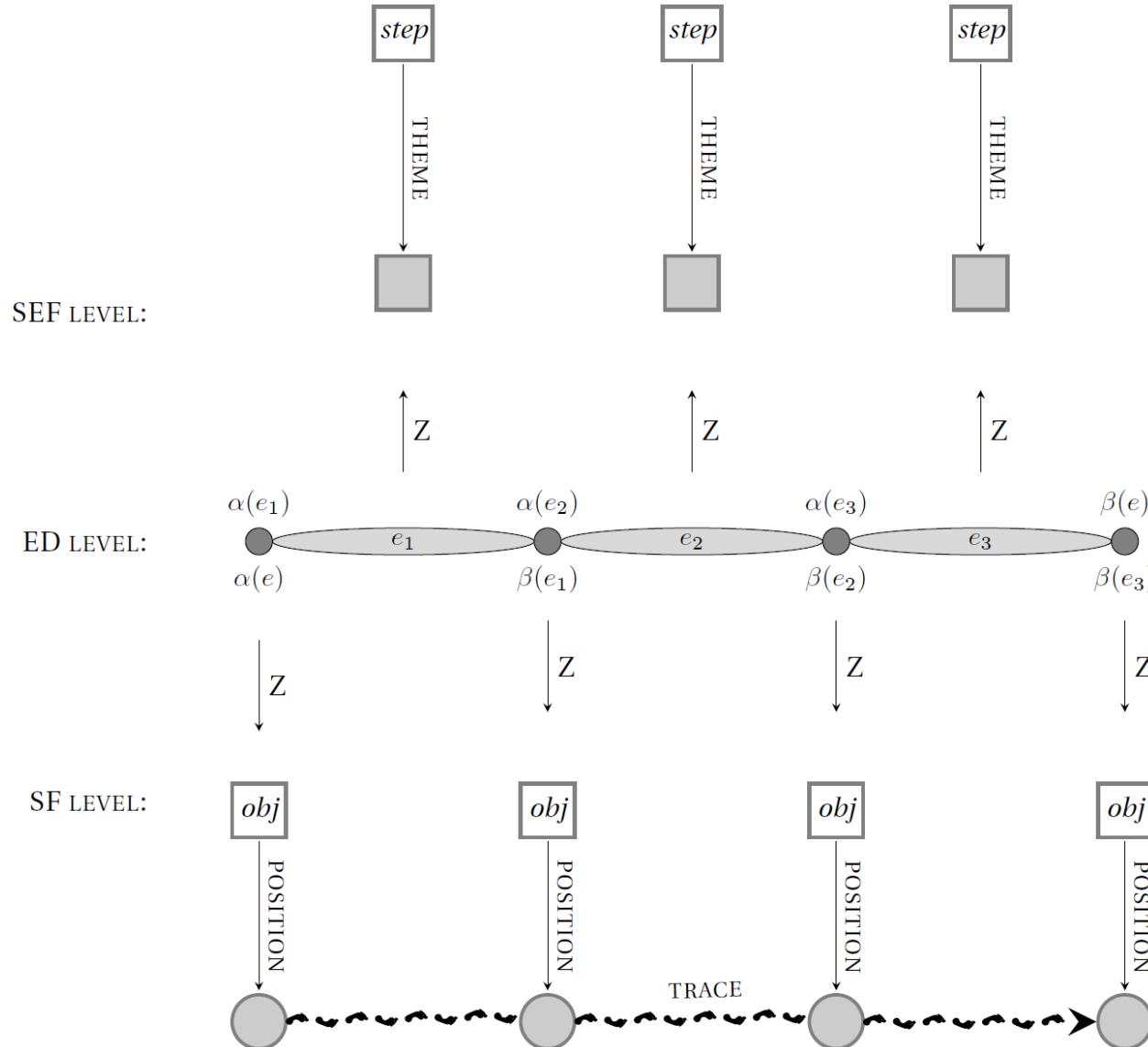
Naumann (2013): *static event frames* (SEFs) represent global properties of the overall event/static dimensions



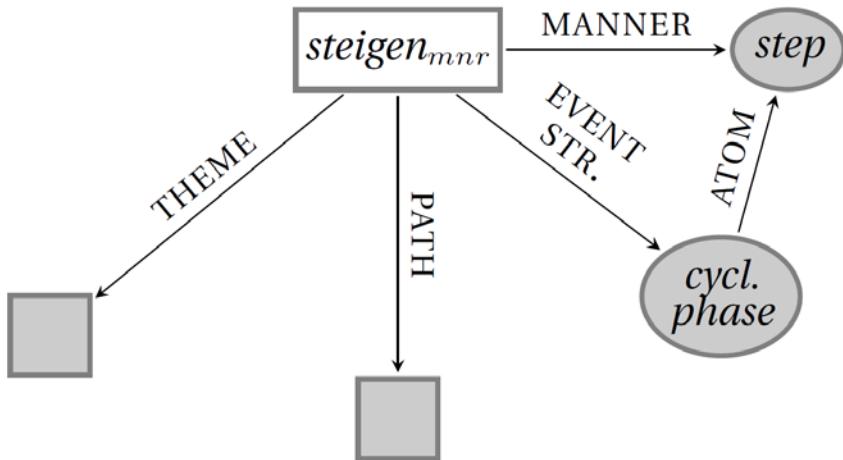
static event frame of *steigen*_{manner}
(Gamerschlag, Geuder & Petersen 2014)

Event structure of *steigen*_{manner}

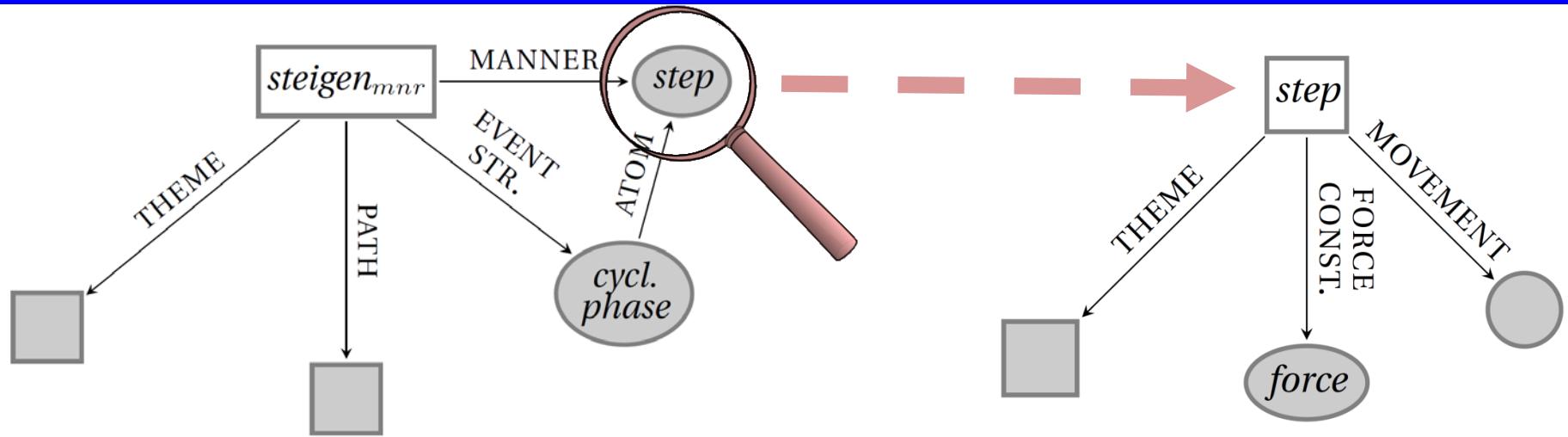
(Gamerschlag, Geuder & Petersen 2014)



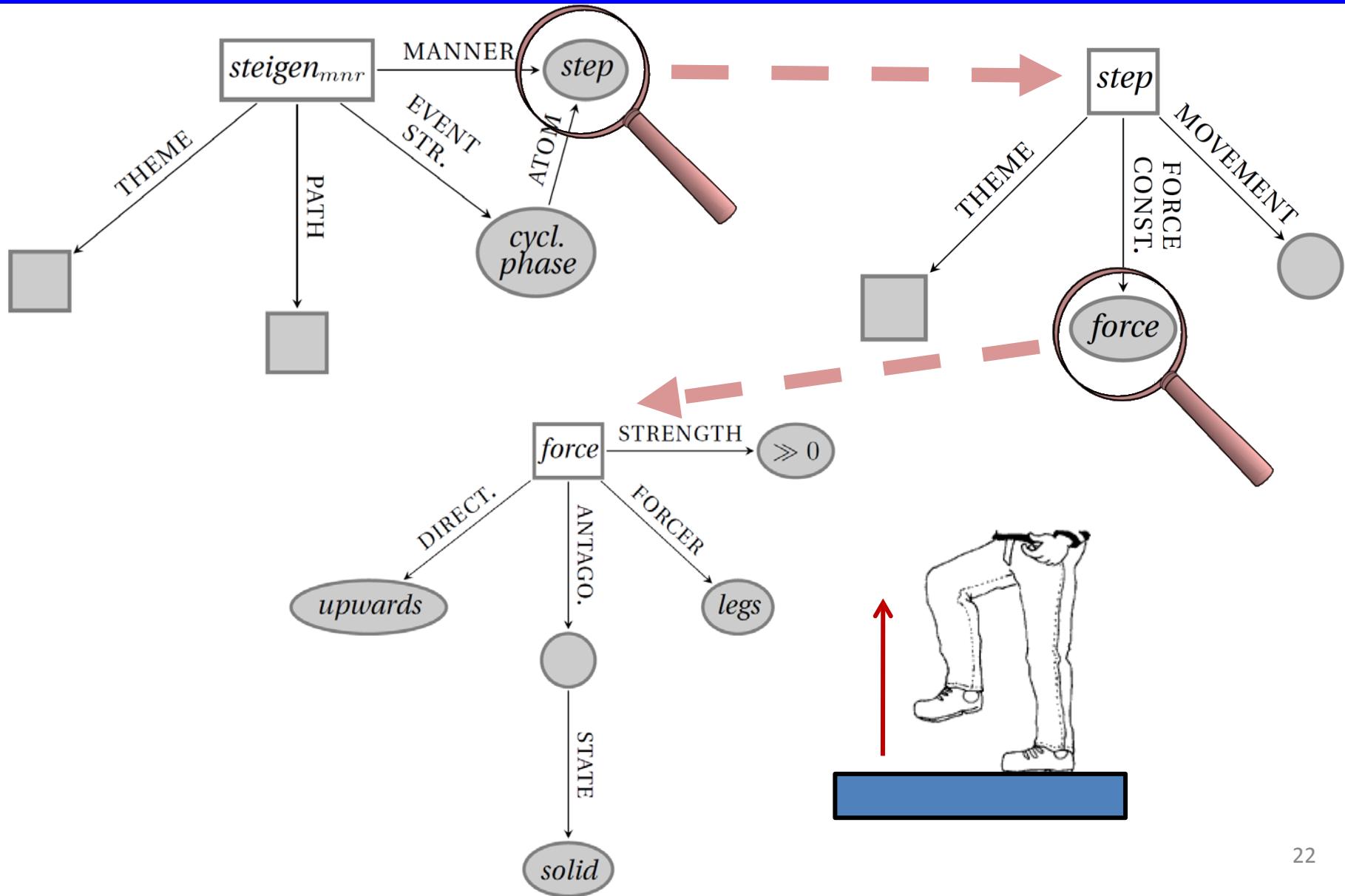
Zooming into the manner component of *steigen*_{manner}



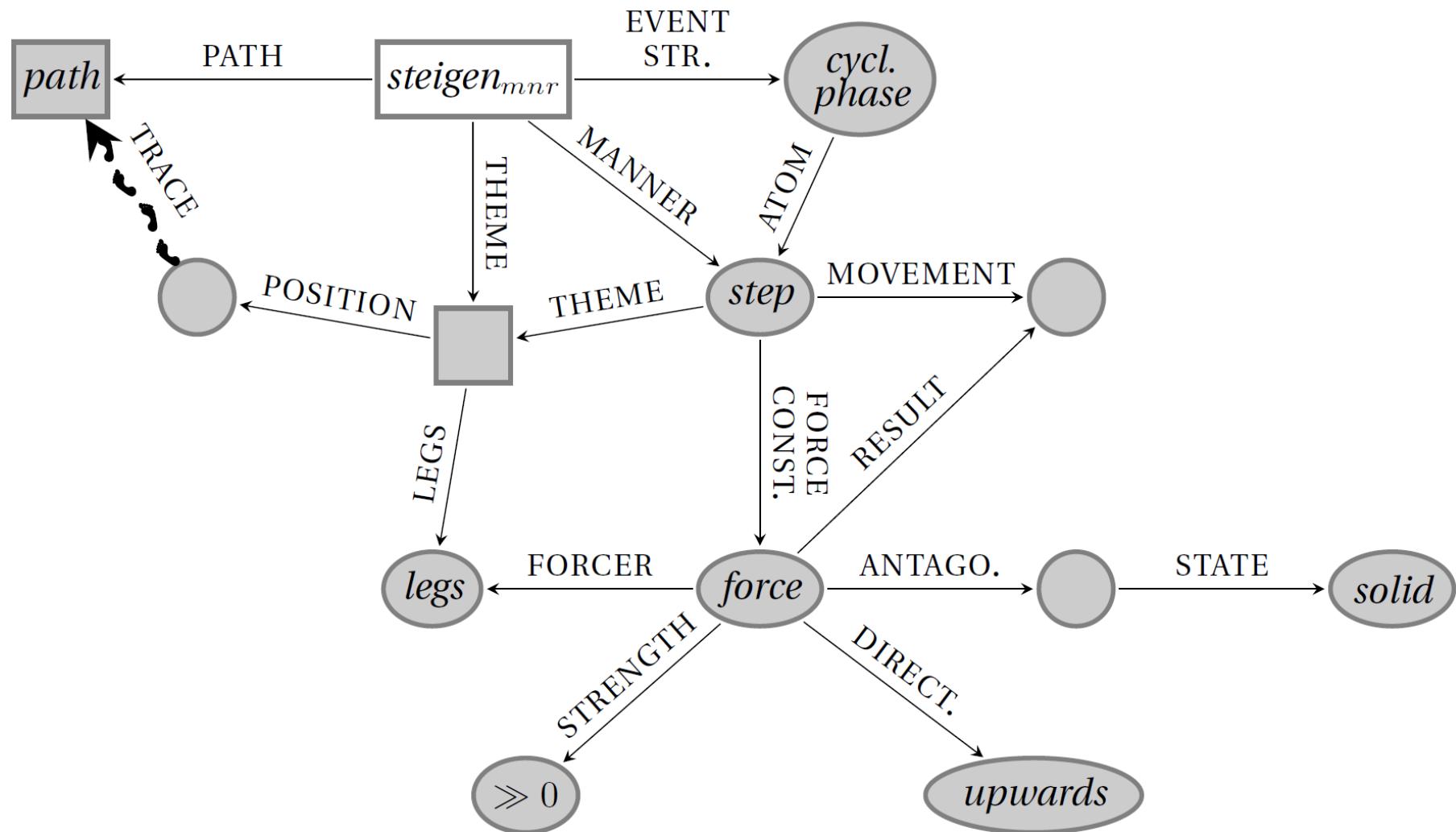
Zooming into the manner component of *steigen*_{manner}



Zooming into the manner component of *steigen*_{manner}



Detailed frame of *steigen*_{manner}



Extending the analysis to *steigen*_{directional}

*steigen*_{directional}:

Der Ballon steigt.

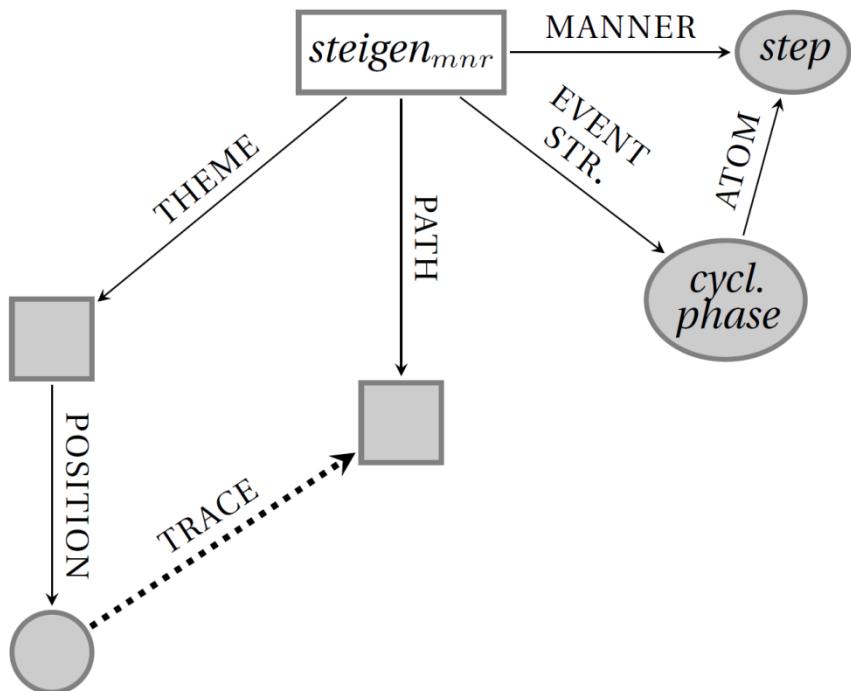
the balloon climbs

'The balloon is climbing.'

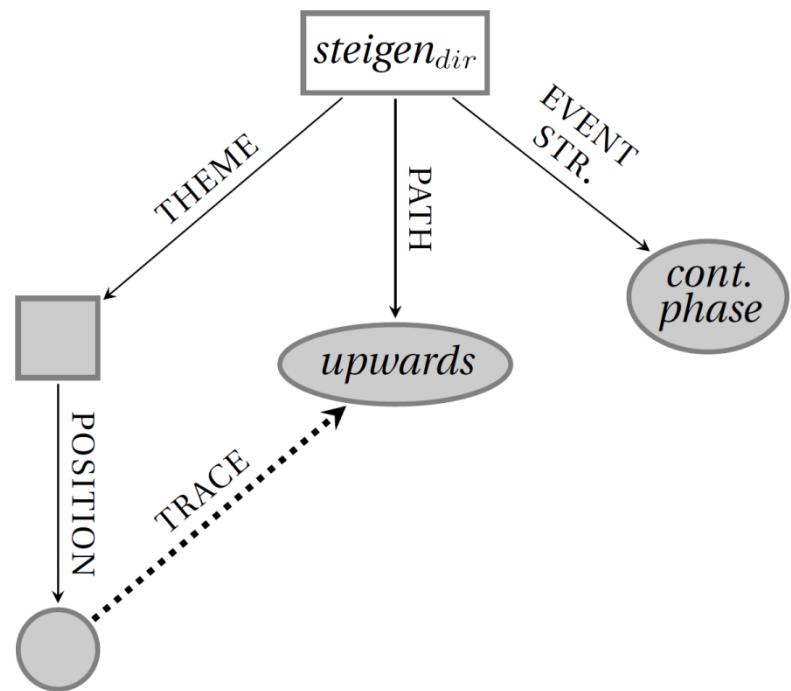


- no reference to limbs
- freely suspended
- only upwards
- dir-comp optional

Frames of *steigen*_{manner} vs. *steigen*_{directional}

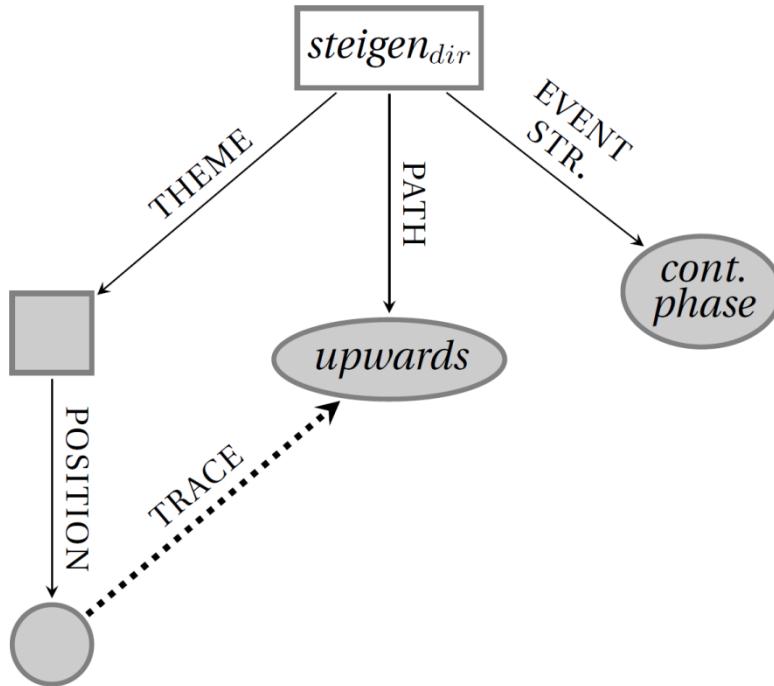


*steigen*_{manner}

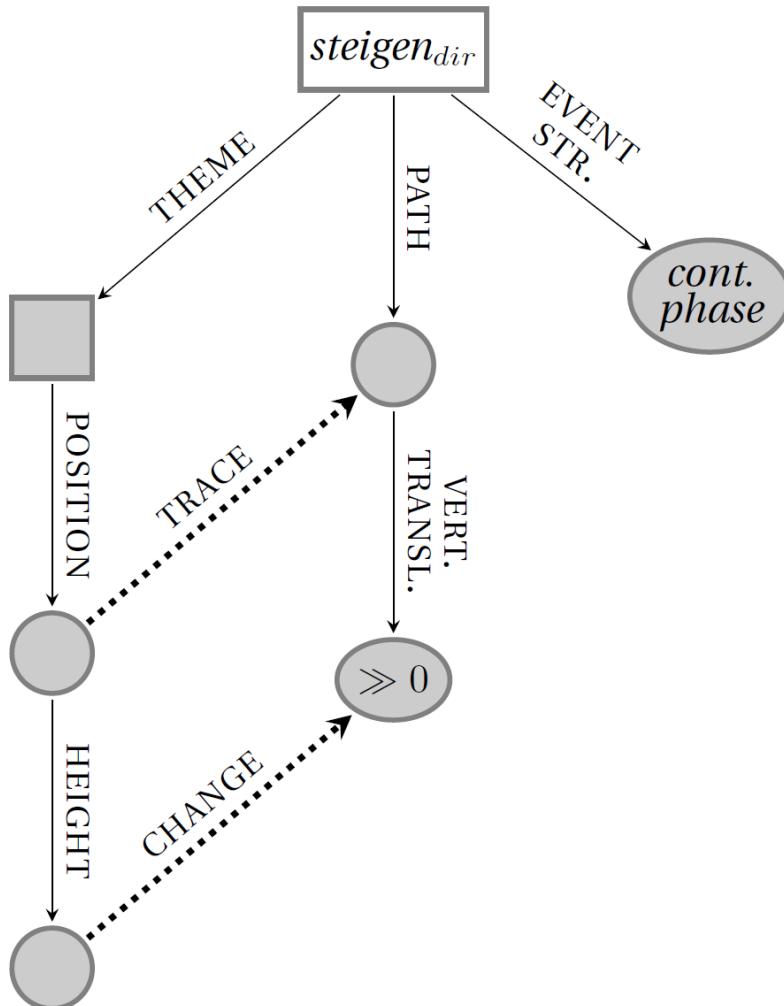


*steigen*_{directional}

Zooming into the "upwards" node of *steigen_{dir}*



Zooming into the "upwards" node of *steigen_{dir}*



Extending the analysis to *steigen*_{figurative}

*steigen*_{figurative}:

Die Temperatur der Flüssigkeit steigt.

the temperature of the liquid rises

'The temperature of the liquid is rising.'



Extending the analysis to *steigen*_{figurative}

*steigen*_{figurative} can only express an increase along the respective scale but never a decrease:

- a. ***Die Temperatur steigt von 3 auf 10 Grad.***
the temperatur rises from to degrees
'The temperature is rising from 3 to 10 degrees.'

- b. ****Die Temperatur steigt von 10 auf 3 Grad.***
the temperatur rises from to degrees
lit.: 'The temperature is rising from 10 to 3 degrees.'

*steigen*_{directional} vs. *steigen*_{figurative}

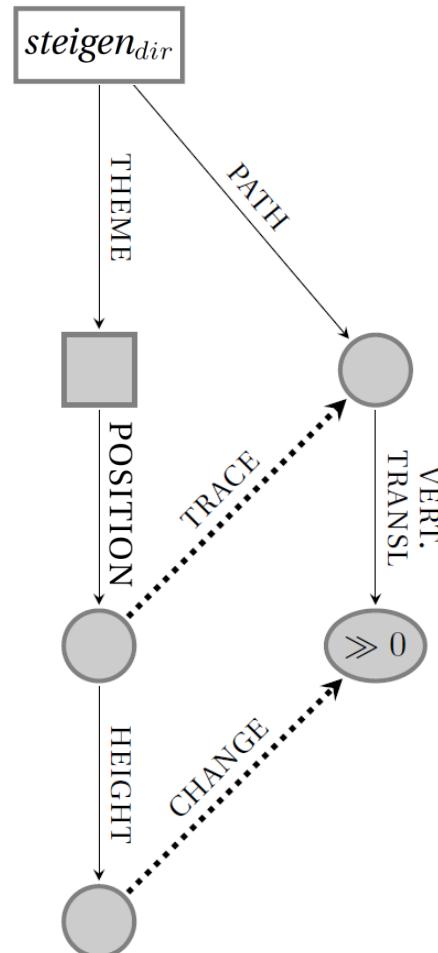
*steigen*_{directional}

- motion along a path scale
- no manner component
- only upwards
- dir-comp optional

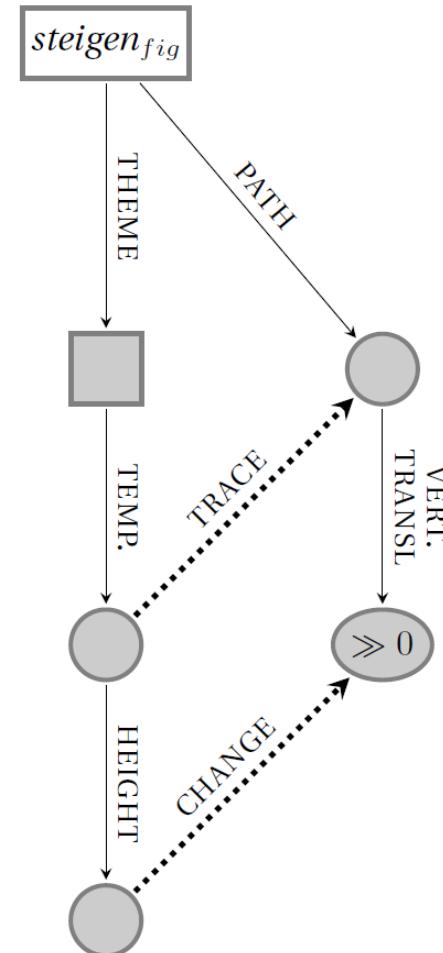
*steigen*_{figurative}

- "motion" along a quality scale
- no manner component
- only upwards/increase
- dir-comp optional

Frames of *steigen*_{directional} vs. *steigen*_{figurative}



*steigen*_{directional}



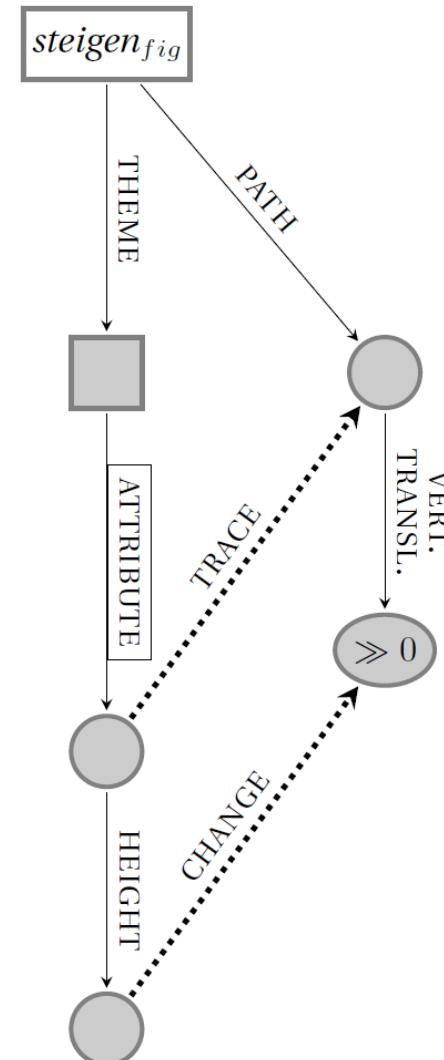
*steigen*_{figurative}:
die Temperatur steigt
'the temperature is rising'

*steigen*_{figurative}: generalized frame and external attribute realization by the subject

die Temperatur der Flüssigkeit steigt
'the temperature of the liquid is rising'



'the temperature of the liquid'



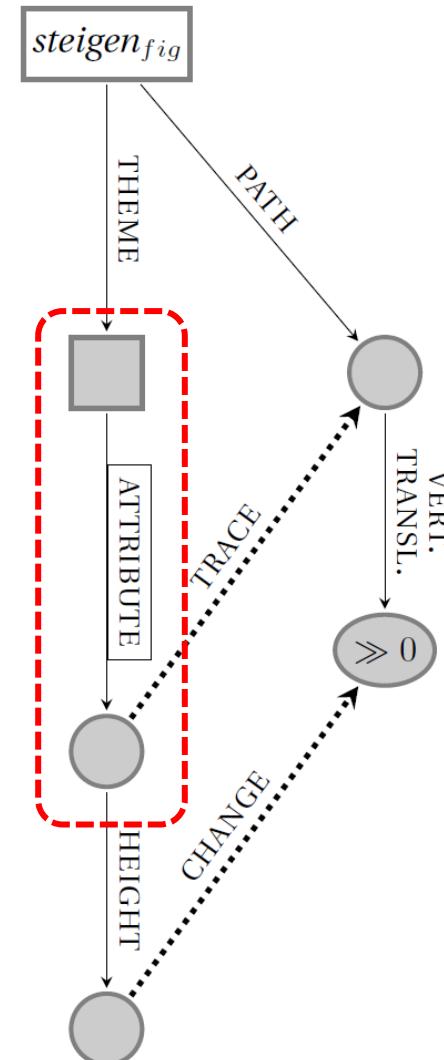
*steigen*_{figurative}

*steigen*_{figurative}: generalized frame and external attribute realization by the subject

die Temperatur der Flüssigkeit steigt
'the temperature of the liquid is rising'

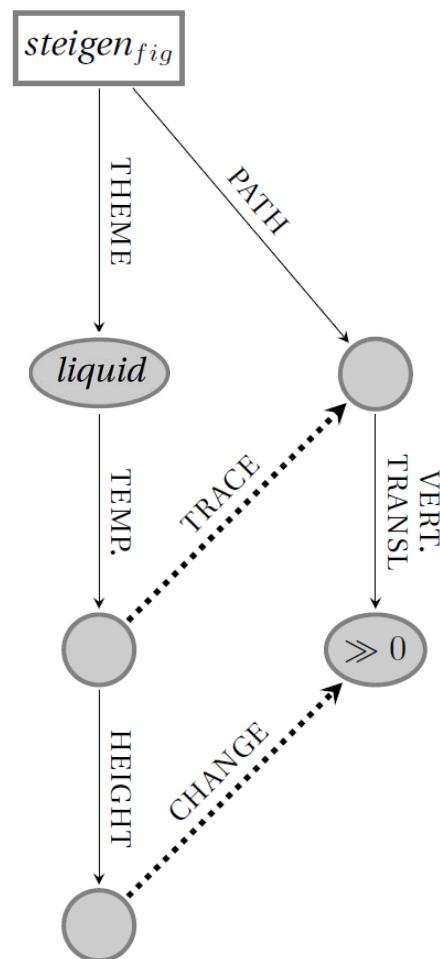


'the temperature of the liquid'



*steigen*_{figurative}

*steigen*_{figurative}: generalized frame and external attribute realization by the subject



die Temperatur der Flüssigkeit steigt
'the temperature of the liquid is rising'

Conclusion

- An adequate analysis of the major uses of *steigen* requires explicit reference to the "anatomical" details of these uses such as subevents, manner, positions and the overall path traversed by the theme argument
- Frame representations show a flexible degree of complexity (zooming in and out by expanding/not expanding nodes) which allows for easy access to the relevant details of each use

Conclusion

- The relationships that hold between the different uses can be analyzed by comparing the structures of the corresponding frames
- The figurative use of *steigen* can be derived from the directional use by a minimal modification of the frame for directional *steigen* which allows for the integration of an attribute contributed externally by the subject