

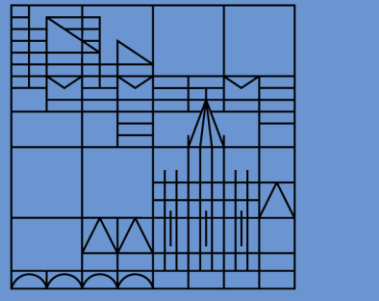


<https://babel.is.tue.mpg.de/>

BABEL: Bodies, Action and Behavior with English Labels

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Human Movement & Semantics

Long term goal

- Understanding what actions are being performed, how, and why.
- Requires datasets of human actions with semantic labels.

Problem

- Existing mocap datasets only contain a few actions.
- 3D datasets only label 1 action in the entire sequence.

Idea

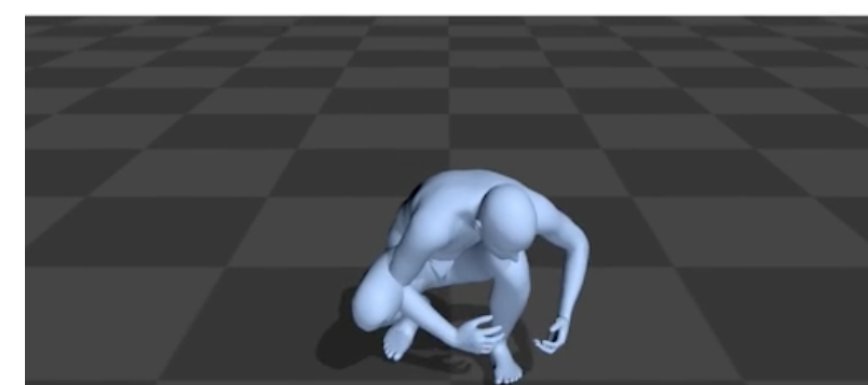
- People often perform multiple actions simultaneously, and sequentially, with transitions between them.
- Natural human movement => modeling relationship between:
 - a) an action and its movement.
 - b) different actions that occur simultaneously and sequentially.

Contribution

- Large dataset of diverse action labels for MoCap sequences in AMASS [1].
- Precise start and end of all actions in the sequence are labeled.

Data Collection

Web Interface(frame labels)

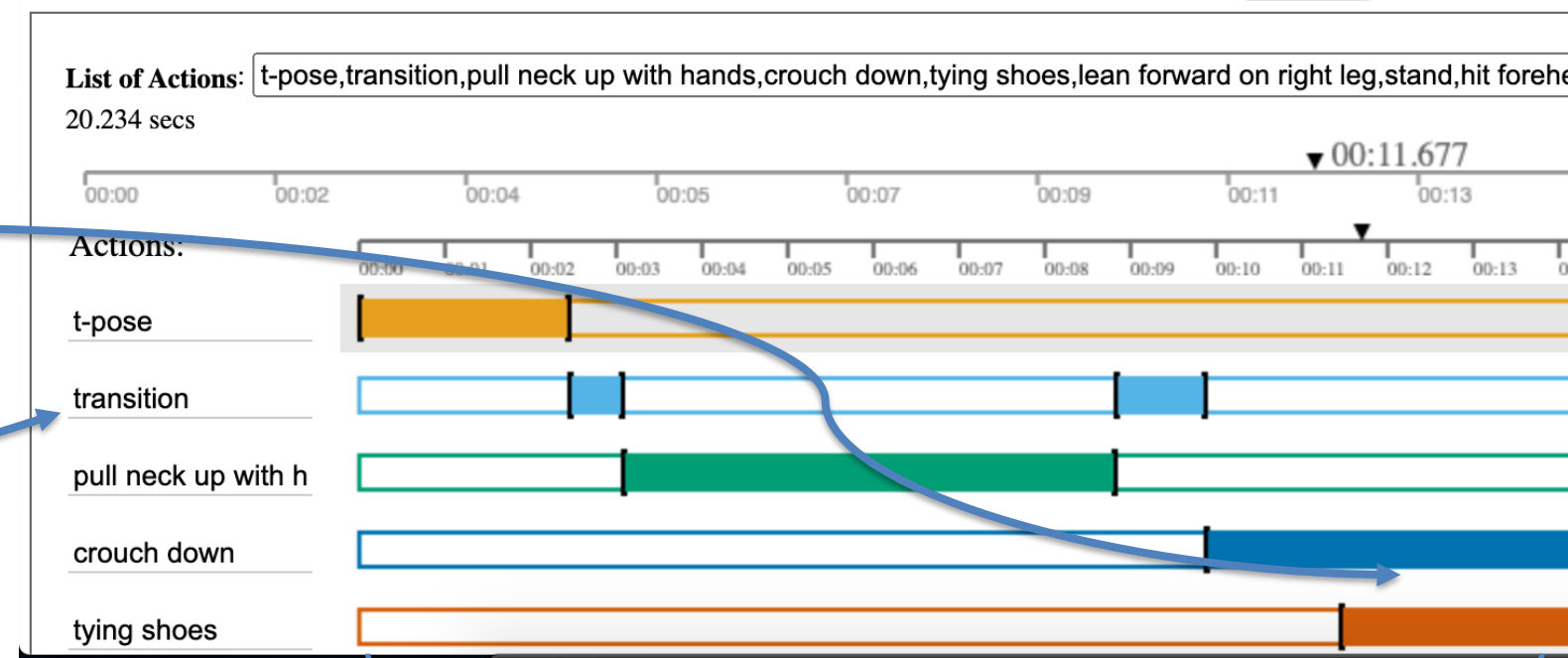


Please watch the demo video proceeding!
As a quick reminder, here's a in Instructions.

Instruction Summary :

1. Name all the actions in
2. Click Update to cre horizontal bars.
3. Mark the duration for e action timeline and pres the Backspace key
5. Be sure to mark the tra
6. Mark all simultaneous
7. Be sure to mark all the videos, the action timel the demo video).
8. Submit once all videos

Press Space to play/pause



Dense annotation: All frames are labeled with at least 1 action.

Annotators in Babel are from Amazon Mechanical Turk¹.

Action labels at 2 levels of resolution:

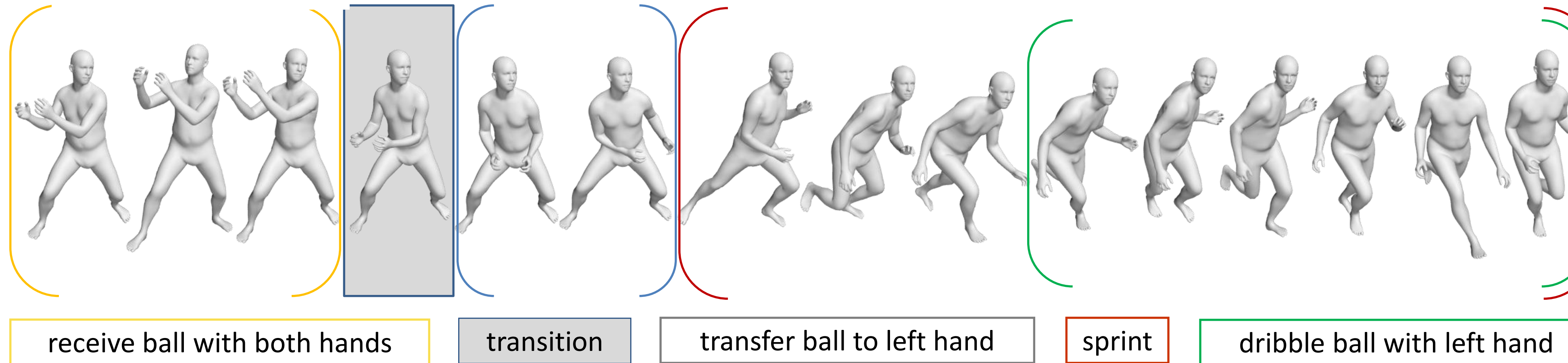
1. **Sequence label** for overall action in entire sequence.
2. **Frame labels** describing precise span of all actions.

Simultaneous actions: All actions occurring in a frame are labeled.

Transitions between actions are explicitly labeled.

¹ <https://www.mturk.com/>

BABEL data



Dataset Comparison

Dataset	GT motion	# Actions	# Hours	Per Frame	Continuous
CMU Mocap [2]	✓	23	9	✗	✓
MoVi [3]	✓	20	9	✗	✓
Human3.6M [4]	✓	17	18	✗	✓
LaFan [5]	✓	12	4.6	✗	✓
HumanAct12 [6]	✗	12	6	✗	✗
NTU RGBD 60 [7]	✗	60	37	✗	✗
NTU RGBD 120 [8]	✗	120	74	✗	✗
BABEL (Ours)	✓	256	43	✓	✓

Temporally Adjacent Actions

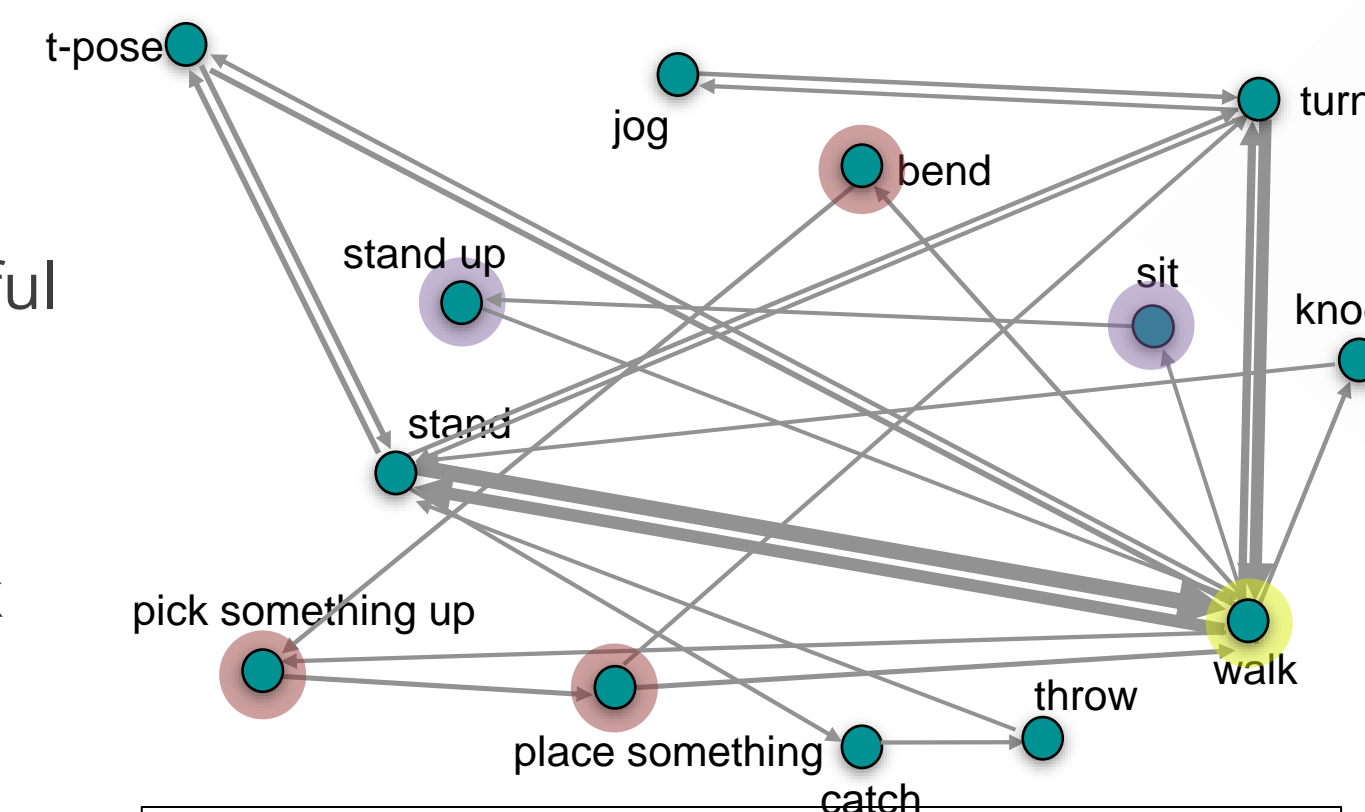
We visualize the most frequent transitions between actions in BABEL.

“walk” has the most diverse set of adjacent actions.

Semantically meaningful action chains:

- sit → stand up → walk
- walk → bend → pick something up → place something

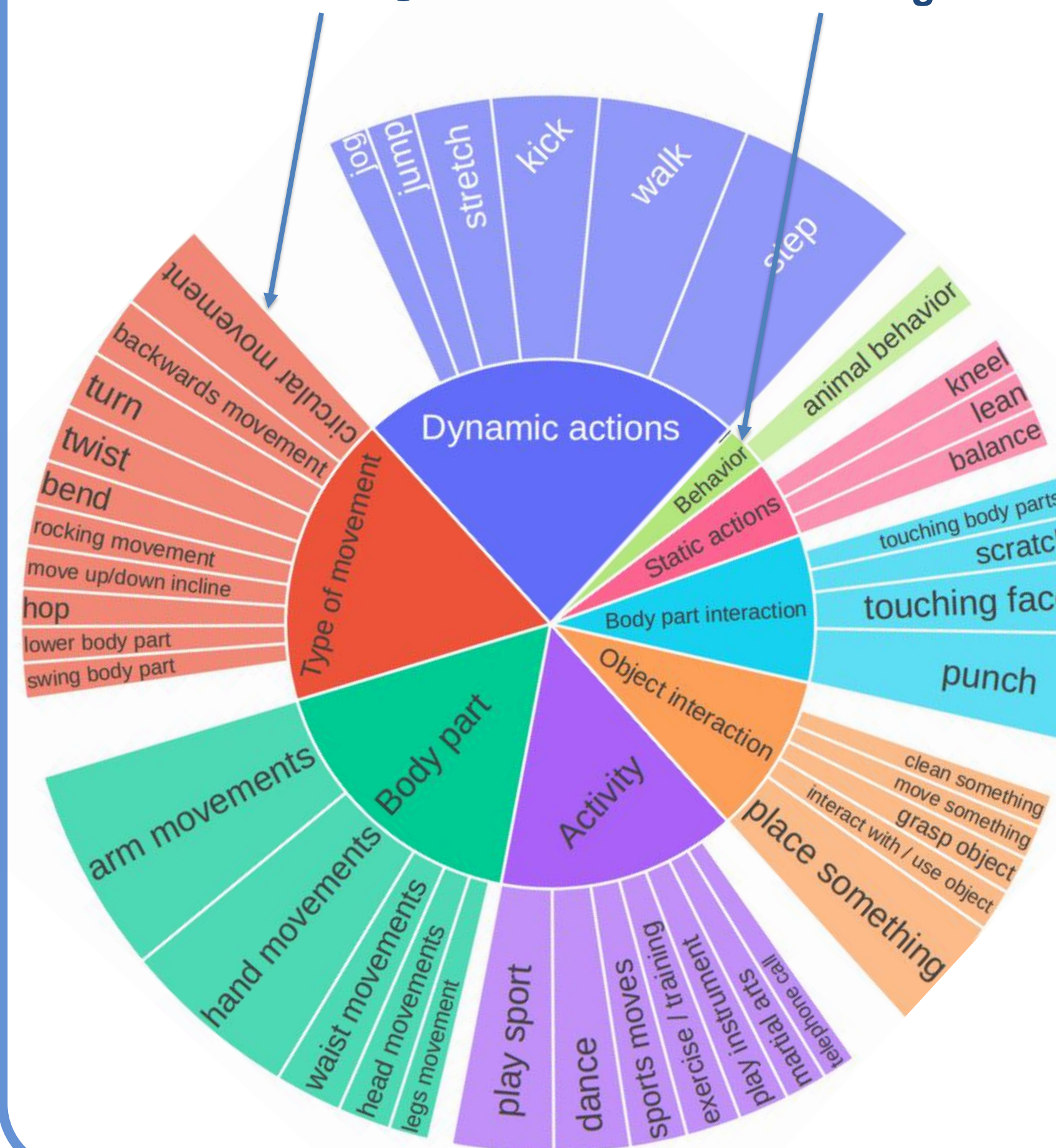
Frequent action transitions in BABEL



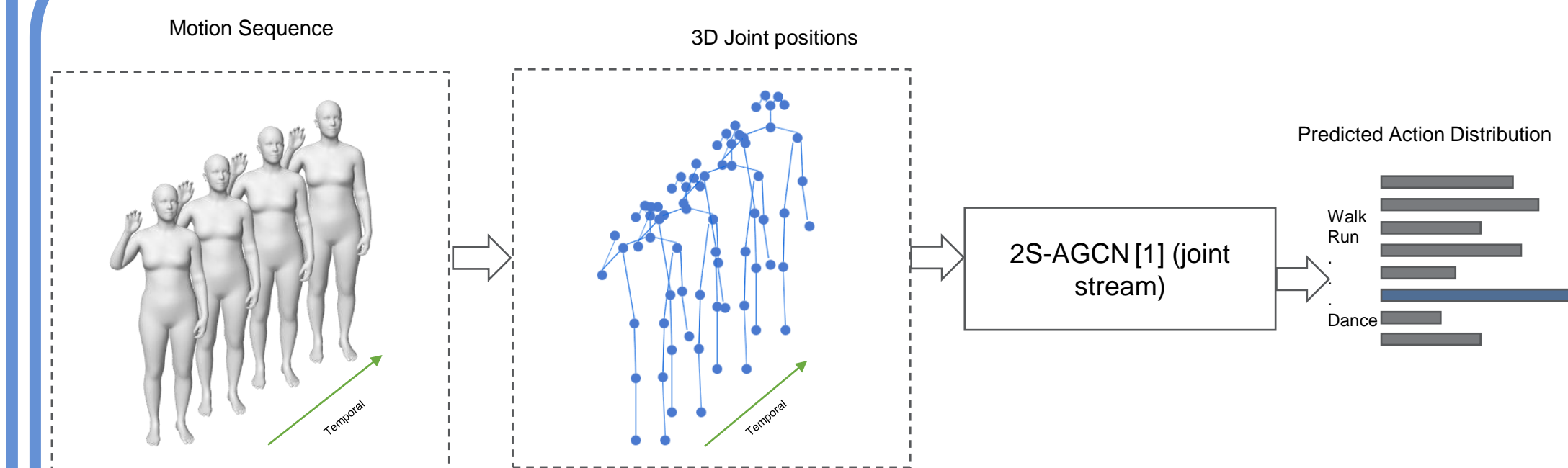
Action Categories

- Action labels for 13220 mocap sequences.
- More than 100k action labels from over 250 unique action categories.
- Long tailed distribution of actions.
- English labels from annotators are organized into:

1. Action Categories
2. Semantic Categories



3D Action Recognition Benchmark



- **Task:** 3D Action Recognition
- **Model:** 2s-AGCN [10] (joint stream)
- **Dataset:** BABEL-60 (subset of BABEL)

CE = Cross Entropy
Top-1 norm = Avg. Top-1% across categories.

Dataset	Loss	Top-5%	Top -1%	Top-1 norm%
NTU-RGBD 60 [7]	CE	97.00	85.72	85.79
BABEL-60	CE	73.18	41.14	24.0
	Focal	67.83	33.41	28.10

- **Long tail in BABEL =>** Top-1 norm% << Top-1%.
- **Focal loss =>** Reduction in class bias.
- **Saturating performance on NTU-RGBD 60 =>** BABEL is a more challenging benchmark.

Applications of BABEL: action recognition, motion synthesis, temporal action localization, etc.

References

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