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THEORY

- Gestures
- lighten the cognitive load
 - are an extension and act of thought
 - may support simulation of physical systems

Gestures show information that may not be present in speech.

Hands and speech either match or mismatch, where a mismatch is any time the hands and speech represent distinct descriptors.

OUR EXPERIMENT

Participants were sophomore-level students who had recently completed a course in classical mechanics.

Interviews were video- and audio-recorded.

Students were asked to consider the trajectory of a ball being thrown into the air.

OUR CLAIM

Gestures allow a person to think about two ideas at the same time, as shown by instances of gesture-speech mismatch.

In our experiment, these ideas included position, speed, acceleration, gravity, and air resistance.

We observed simultaneous gesture-speech matches and mismatches.

References

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7. A. Kendon, Semiotica 4, 191-209 (2001).
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Reasoning and Conclusions

Speech typically allows one expression of thought at a time, while gestures seemingly allow for multiple expressions often not portrayed in speech.

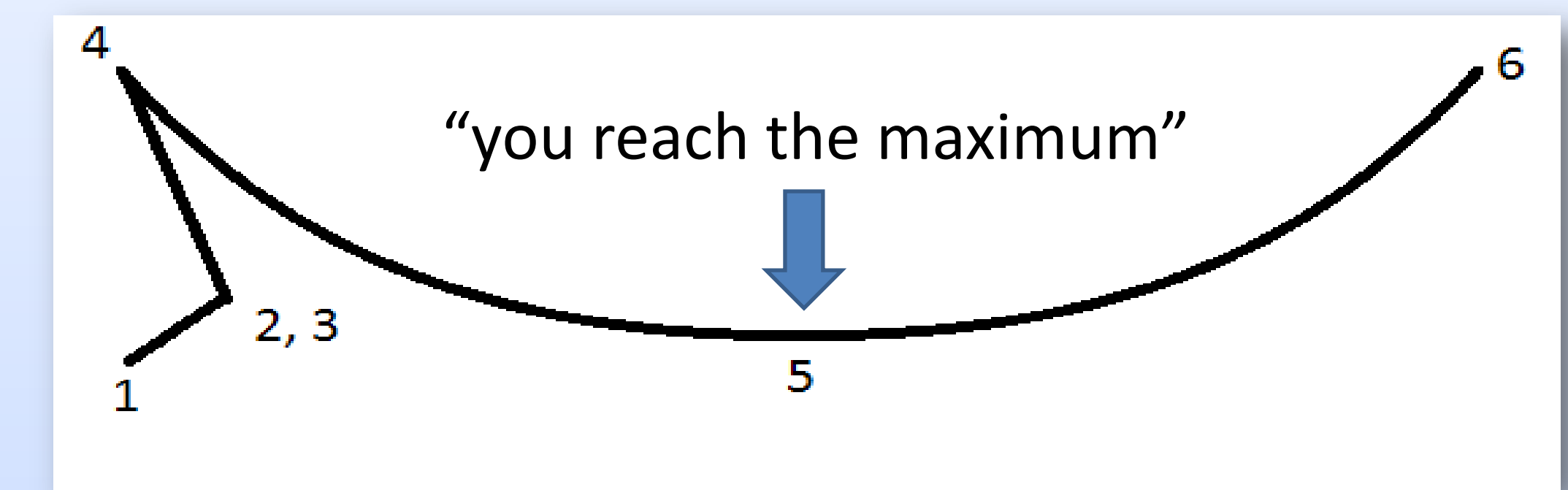
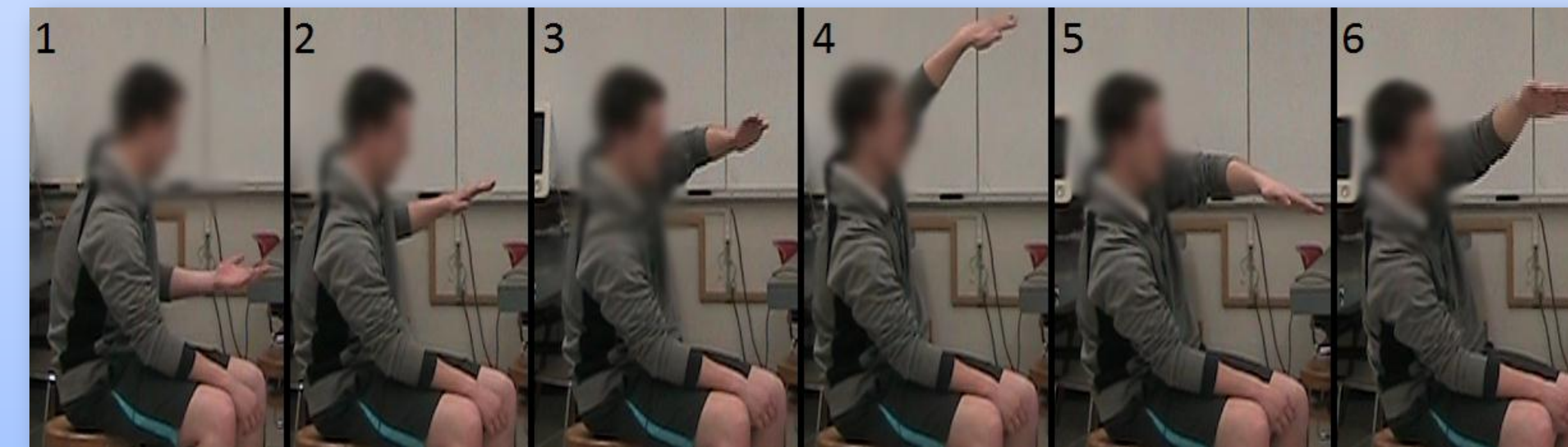
When discussing single descriptors, the speech seems to explain the gesture, or there is no gesture at all. However, when making comparisons between related descriptors, such as position and speed or acceleration, we see that the gesture portrays one, while the speech portrays the other. Sometimes one gesture can simultaneously match and mismatch with the speech.

Our data suggest that gesture-speech mismatches are evidence that a person is thinking about two ideas at the same time.

Talking about position, showing speed

Anthony described the motion of a ball thrown into the air, beginning from the moment of release and ending at the moment the ball started to come back down from its maximum height.

“Well (1), as you go along the velocity (2), you have some initial velocity (3), or, it starts here (4). It goes here, you reach the maximum (5), and then it goes (6), back up more.”



(Recreated front-view of hand trajectory)

After this episode, Anthony explained that “maximum” referred to the maximum height.

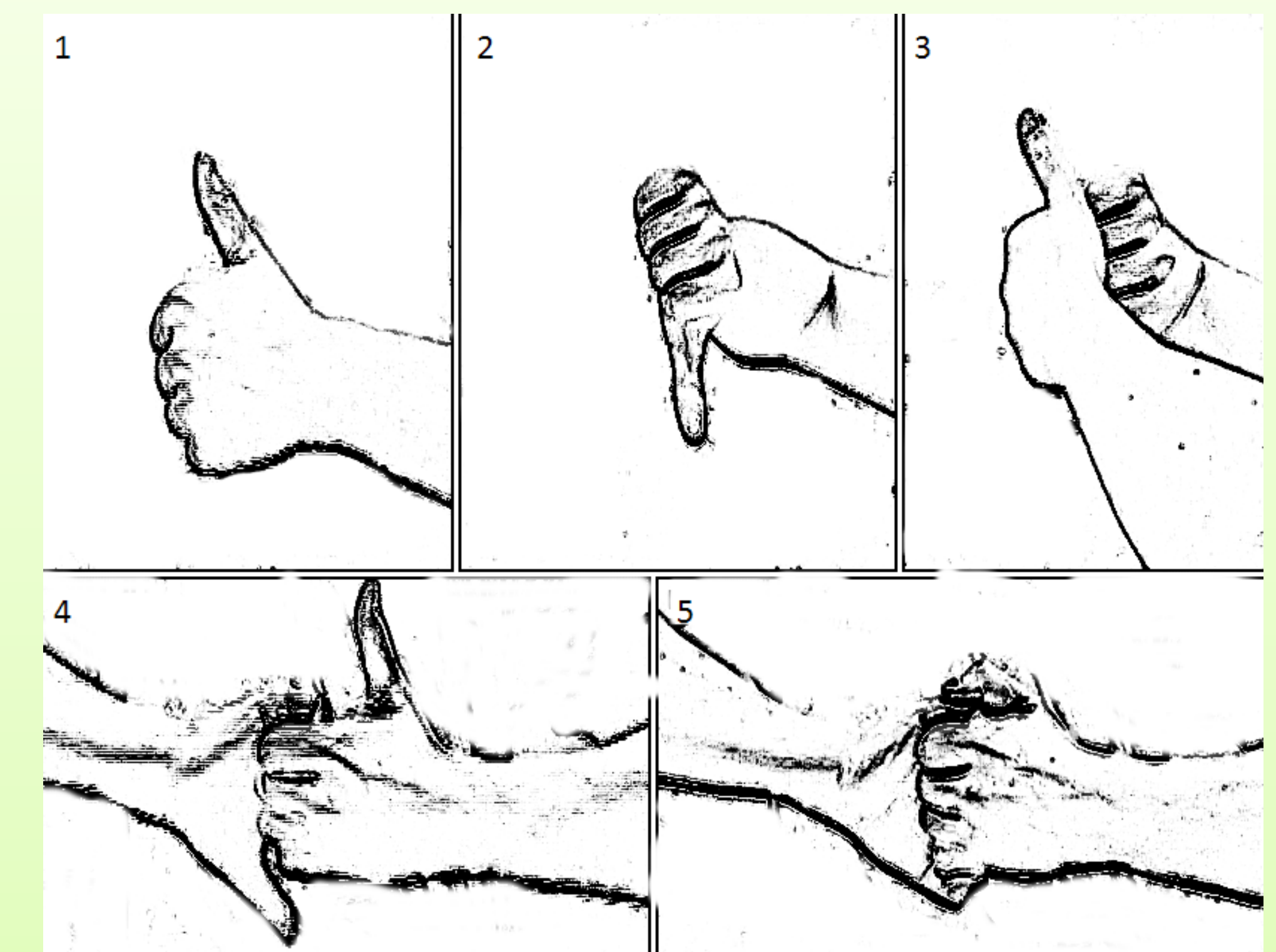
| | Speech | Gesture |
|----------|----------|----------|
| 1 to 3 | Speed | Position |
| 4 to 6 | Position | Speed |
| 6 to end | Speed | --- |

Talking about acceleration, showing summation of forces

Jeff described a ball falling from the top of its trajectory.

“and so air resistance (1) opposes (2) gravity (3) when it’s falling down. (4) So your (5) acceleration is actually decreasing, as objects fall.”

| Picture | Quantity | Hand |
|---------|---|------------|
| 1 | Air Resistance | Left Hand |
| 2 | Gravity | Right Hand |
| 3 | Right hand passes over and behind left hand | |
| 4 | Fingers interlock (SUMMATION) | |
| 5 | Fingers close (TOTAL ACCELERATION) | |



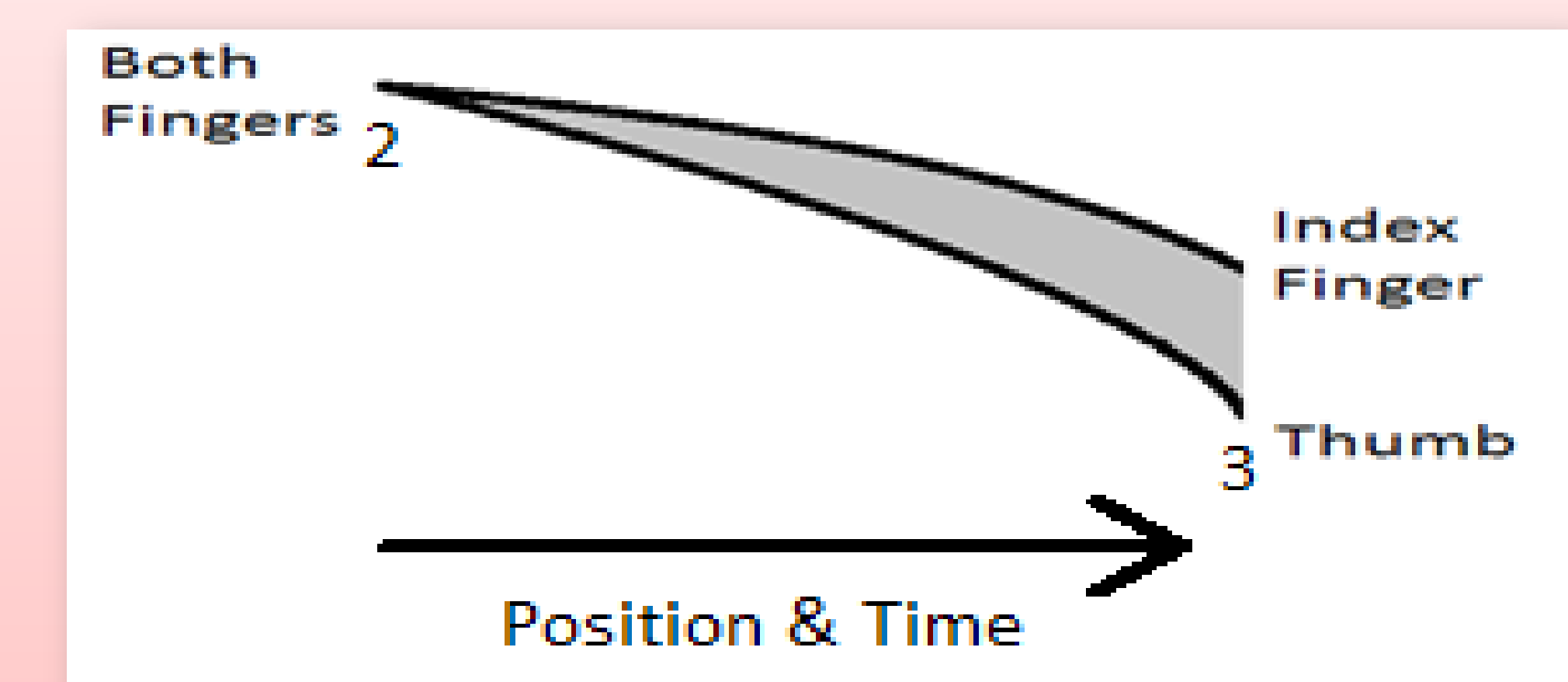
(Pictures above line-drawn from video data)

Jeff’s gestures represent the addition of forces, while his speech describes the net acceleration.

Talking about speed, showing speed and position

Anthony discussed a ball at its maximum height and as it fell.

“Your velocity will still increase to some point, and then it will become like (1), a zero point at the very top (2), because it’s all potential so there’s no velocity. And then, once you start (3) moving again you have kinetic so then your (4) velocity’s gonna increase (5).”



(Representation of hand and finger motion)

Anthony’s gestures yield two representations, which match and mismatch with speech.

| Medium | Quantity |
|---------|----------|
| Speech | Speed |
| Hand | Position |
| Fingers | Speed |