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Background

The field manuals were originally intended as working documents for internal use only. They were supplemented by verbal instructions and additional guidelines in many cases. If you have questions about using the materials, or comments on the viability in various field situations, feel free to get in touch with the authors.

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Folk theories of objects in motion

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Background

How are motion events and their causes conceptualised? Human interaction with the physical world requires knowledge about the behaviour of objects in different circumstances. In order to adapt actions to external conditions, one thing that people have to be able to do is anticipate motion events. People have to be able to foresee the effect that factors such as weight, shape or applied forces might have on the course of an object in motion. Both in cognitive and developmental psychology there is a long research tradition which investigates people's ideas about object motion and dynamics.

There are three main strands of research which have investigated people's intuitive knowledge of objects in motion. (1) Knowledge of the trajectories of objects in motion; (2) knowledge of the causes of motion; and (3) the categorisation of motion as to whether it has been produced by something animate or inanimate. We provide a brief introduction to each of these areas. We then point to some linguistic and cultural differences which may have consequences for people's knowledge of objects in motion. Finally, we describe two experimental tasks and an ethnographic task that will allow us to collect data in order to establish whether, indeed, there are interesting cross-linguistic/cross-cultural differences in lay theories of objects in motion. These tasks are pilot tasks in order to establish whether there are interesting differences or similarities the Language & Cognition group could pursue in the future.

First a brief overview of the existing work on intuitive knowledge of motion. Psychologists have investigated people's ideas about motion trajectories. In these investigations it has been shown that people tend to think of the trajectory of a motion as involving two segments. For instance, the course of an object thrown upwards tends to be segmented into a rising phase and a falling phase. Similarly, a horizontal throw is sometimes seen as consisting of two segments. In the first segment the object is seen as travelling in a straight horizontal line and then after that it is seen as falling down in an arc. Intuitions about motion courses can be quite definite. Even from an early age, sharp edges or abrupt turnabouts in trajectories are considered to be highly unnatural (Hecht & Bertamini, 2000; Kim & Spelke, 1999). As well as having specific ideas about the paths involved for an object in motion, people have definite ideas about the speed objects should move at. An object hit along a straight surface is expected to move slower and slower before it stops. A sudden speeding up towards the end of the trajectory would be considered strange (Bingham, Rosenblum & Schmidt, 1995).

A second area of research investigates intuitive knowledge of the causes of motion. One of the most influential ideas to be found in this domain is the "motion implies a force" concept. In their knowledge of objects in motion, people appear to have the assumption that the continuing motion of inanimate objects is the result of either an external mover or an internal force. The force is assumed to act in the same direction as the direction of motion (Clement, 1982; McCloskey, 1983). Underlying the "motion implies a force" idea is a second idea that the default state for inanimate objects is rest. Thus, motion requires an explanandum, i.e. requires a cause.

A third aspect that is relevant for our understanding of motion is to be able to categorise what kind of motion an object is producing. People distinguish between animate and inanimate motion, between caused motion occurring in collisions and spontaneous motion such as when an object falls. Obviously, motion classification is related to ideas about the trajectories and causes of motion: animate motions can have unpredictable trajectories with sudden changes of direction, while inanimate objects typically move linearly (Mandler, 1992). Dynamically, animate and inanimate motion differ in "locus of causation": animate motion is "self-propelled", with the source of power or force being located in the moving object itself, inanimate motion, however, requires an external mover or at least an ephemeral "impetus" stemming from an external source.

This concludes our summary of psychological research on theories of motion. We would now like to point to a number of linguistic distinctions that may be important in how people talk about events of throwing, and then point to some of the consequences this may have for people's thinking about object motion. Some linguistic distinctions that are relevant for talking about thrown objects are: (1) the lexicalisation of events of throwing – what are the verbs for “throwing” in the language? Is there a number of different ways to talk about throwing events? What are the semantics of these verbs? (2) Causatives – how does the language distinguish between self-motion and caused motion? (3) Reflexives and reciprocals – these may be important in some languages as a way of recognising animacy/inanimacy. (4) Aspect – when asking people to describe the path of an object during motion in English (e.g. what is the trajectory of the ball as it's falling?) we use the progressive aspect. What are aspectual distinctions in the language and how does one ask questions about path of motion during motion? (5) Endstate orientation – some languages are oriented towards the resultant state and are less concerned with motion between beginning state and end state. This may have implications for asking people to reason about trajectories, etc. This is not an exhaustive list of the linguistic distinctions that may be important for talking about throwing events. Our goal is to point to some places in the language which may be important in how people talk about and conceptualise motion and force. More specifically, our question is this: given that languages have different linguistic resources for talking about objects in motion, what are the consequences of these differences for people's thinking about motion?

In order to tap into the intuitive knowledge of motion we have developed two experimental tasks which use directed interviews in order to elicit people's thinking about motion. The experimental tasks are designed to elicit a broad range of motion descriptions, motion explanations and gestures which might serve as a starting point for the study of intuitive ideas about motion and its causes. Our goal is to establish people's habitual knowledge of motion events. Following the experimental tasks, we also give an outline of a procedure for an ethnographic study investigating indigenous practices of throwing. Of special interest is the practical knowledge underlying expert throwing. You can do EITHER the experiments (section 2), OR the ethnographic study (section 3), OR both.

2. EXPERIMENT / DIRECTED INTERVIEW: THE 4 BALLS TASK

Stimuli:

4 balls (golf ball, ping-pong ball, large styrofoam ball, wooden ball) plus piece of wood
[Collect equipment from Asifa if you wish to collect data for this task.]

Procedure:

This task will take the form of a structured interview. You will need to prepare these questions in the field language, being sensitive to the linguistic distinctions mentioned in the introduction.

There are two types of scenarios that you will be asking your consultant about. One is about force and motion for objects travelling a large distance (Task 1), the other about motion and force for a smaller distance (Task 2). The protocol for each of these is described below.

Consultants:

As this is a preliminary task, three consultants will suffice (five would be ideal).

Task 1: Motion and force over a distance

We are interested in how people reason about objects travelling a large distance. What kind of knowledge do people have of the influence of features of objects (size, weight) that influence motion over a distance, the forces involved and the trajectory of objects as they are thrown?

For this task you will require the four balls from the stimulus kit.

Preliminary:

1. Place the balls in front of the consultant.
2. Allow the consultant some time to interact with the balls, if they so wish.

Rank order the balls:

3. Ask the consultant which ball can be thrown the furthest from where you both stand.
4. Ask the consultant to order the balls from the one that can be thrown the furthest, to the one that would travel the least distance.

Reasons for rank order:

5. We want to know about the reasoning involved in the consultants rank ordering. Ask the following questions: Which one can be thrown furthest? Why? But it is so small / heavy / large? Why not this one? Which one comes next? What is the difference between this one and the first one? Why doesn't it go as far as the other one? Etc.

Throwing:

6. Here we want to know about the implicit knowledge that people have about *how to* throw objects in order to make them travel a large distance. The consultant should indicate how they would throw the ball in order to make it travel the furthest distance.
7. What is the angle of the arm with respect to the body when the ball would be released? Is the arm straight when the object is released? Is the arm directly overhead? In front? At an angle?

Trajectory:

8. How will the ball move as it is thrown? What will be its trajectory/path? Ask the consultant to gesture the path. Make sure to have the appropriate angle to the video camera. You should film this so that the trajectory can be seen from the side, and not front on.

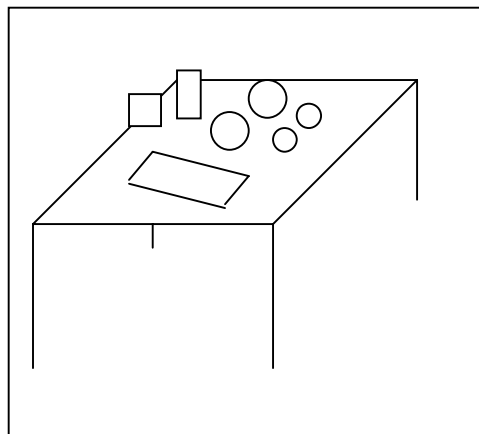
Dynamics (forces acting during motion)

9. What are the forces acting on the object once it has been thrown? Why does it fall (gravity?)?
10. If there were wind coming from behind, from the side, from the front, how would the ball travel? Does anything change: trajectory, direction etc?

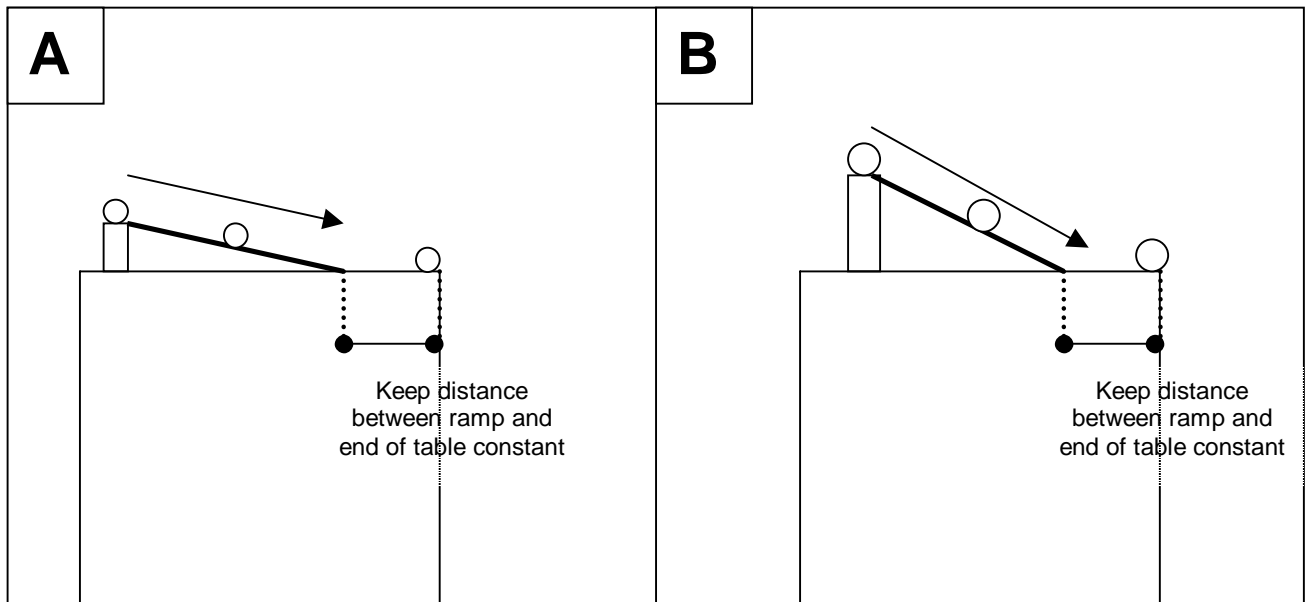
Task 2: Motion and force on a small scale

Here we are interested in the understanding people have about objects travelling over a small distance. How do people reason about objects when force comes not from throwing, but from the object being allowed to travel down an incline?

For this task you will require the four balls and the piece of wood from the stimulus kit. Additionally, you will require a table, or equivalent, and two blocks of different heights to rest the piece of wood on.



First, you must have the basics of the ramp. You need two blocks (something like a box will do the job), of different heights. When you rest the wood on the blocks you should have an incline which you can use to roll the balls down.



When you have the incline set up, you can put the ball on the top of the incline and just let it go. Do not push the ball with your hand (that is, no additional force should be added to the ball's motion). Familiarise the participants with both inclines. Make sure they are aware that the inclines are of different steepness. Then one by one allow the balls to roll down both inclines. (Stop the ball with your hand as it reaches the table's edge.) You can let participants see them in any order. Ask the following questions:

Ramps:

1. Which ramp would make the ball go furthest, A or B? Why?

Balls:

2. Which ball would go furthest? Why?

Trajectory:

3. What will be the trajectory/path the ball follows as it falls?

Dynamics (forces)

4. Why does the ball fall / go down?

3. ETHNOGRAPHIC STUDY ON INDIGENOUS PRACTICES OF THROWING

We are interested in the practical knowledge underlying culture-specific throwing practices. Relevant practices are: throwing of spears, arrows or harpoons, use of slingshots etc.

The investigation should include the following elements:

- a. You should film some actual episodes of throwing. Make sure that you include the aiming phase of the activity.
- b. An interview about the throwing practice should be conducted with a “practitioner”. Since interviews with the expert and the ethnographer as sole participants might not accurately or fully reflect knowledge underlying the practice, we suggest taking a video record of an “instructional” context. Here, the expert would explain the practice to a novice. Technical vocabulary related to the throwing practice should be collected.
- c. In case special instruments are involved in the practice (e.g. spears), an interview about their production could be conducted. Which kind of material is used? What would happen if one would choose a lighter/ heavier material? Are there rules for determining the right measures (e.g. length)? How would a change of these measures effect parameters of throw (its width etc.)?

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