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# Motor-concept variation in the German verbs *anfassen*, *angreifen*, and *anlangen*. Differences between Austria, Germany and Switzerland

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## Abstract

The semantics of German ‘touch’ verbs include corresponding motor concepts. These seem to result from experiences and learning from subjective bodily actions and interactions with the environment during language acquisition (cf. Bailey 1997). When we learn a new action word, we often do so embedded in a particular motor context (cf. Bergen et al. 2004; Bailey et al. 1997). In this pilot study, we investigate how the motor concepts of German hand-related ‘touch’-verb variants ([*an*]*fassen*, [*an*]*greifen*, [*an*]*langen*, cf. *VWB*: 38–39, 40, 42) – which are often considered to be true synonyms – are applied by speakers from Austria, Germany and Switzerland. The empirical study draws on research into cognitive semantics (Pulvermüller 2005; Steels and Belpaeme 2005) and motor cognition (Marocco et al. 2010; Bailey et al. 1997) and aims at adding a variationist linguistic component to the existing research (cf. Fink in prep.). By use of a stimulus response experiment with 25 native speakers from the three countries, we will show a) that the three verb variants differ in terms of motor concepts and therefore are no true synonyms and b) that the motor concepts for each verb differ between speakers of German in Austria, Germany and Switzerland.

## 1 Introduction

The three verbs *anfassen*, *angreifen* and *anlangen* are described as synonyms with the meaning ‘mit der Hand berühren, ergreifen, mit den Fingern befühlen’ [to touch with the hand, to grasp, to palpate with the fingers] (Duden Online)<sup>3</sup>. The three verbs have different regional distributions across Austria, Germany and Switzerland as presented by the *Atlas der Alltagssprache*<sup>4</sup> (=AdA, Elspaß and Möller 2003ff.) [Online atlas

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<sup>3</sup> <http://www.duden.de/woerterbuch> (accessed 26 December 2015).

<sup>4</sup> The atlas maps regional variants of colloquial German and, thus, neither focuses on the standard variety nor on dialects, but on an ‘intermediate’ variety. It shows a similar distribution of the

of colloquial German] for different parts of the German-speaking area<sup>5</sup>: Roughly, *anfassen* is used as the default verb for ‘touch’ actions in Germany (but is less frequent in southern Germany), *anlangen* is used in southern Germany and in Switzerland, and *angreifen* is used in Austria (cf. Figure 1). Following Pulvermüller (2005), we understand motor cognition as a part of lexical semantics. The goal of our study is, therefore, to investigate whether the selected verbs are true synonyms in this respect or not, by testing this assumption in an experimental ‘touch’-action setting.

We take into account that German is generally considered to be a so-called *pluriareal* or *pluricentral*<sup>6</sup> language and utilize this fact to connect the experiment’s cognitive semantic background with a variationist linguistic approach: this is achieved by the correlation of the motor-concept data with the respective verbs and their regional distributions.

According to Clyne (1992: 1), pluricentric languages are characterized by having “several interacting centres, each providing a national variety with at least some of its own (codified) norms”. With regard to German, this means that its standard varieties have developed different features, lexically as well as grammatically. This is shown by two large-scale research projects on the variation of standard German in Austria, Germany, and Switzerland<sup>7</sup>: (a) for lexical variation the *Variantenwörterbuch des Deutschen*, (=VWB, Ammon et al. 2004 [Dictionary of variants in German]; regarding the new edition cf. Fink et al. in print) and (b) for grammatical variation the *Variantengrammatik des Deutschen* (Dürscheid et al. 2015) [Grammar of variants in German]. The pragmatics of standard language variation has not received as much attention, but there are some studies focusing on pragmatic variation as well (Warga 2008, Muhr 2008, Glauninger 2012 and Habacher 2015). Standard variation for German with regard to motor concepts has, to our knowledge, not yet been investigated.

The primary focus of our study will therefore be placed on the conceptual knowledge (in particular motor concepts) of a small set of seemingly synonymous ‘touch’ verbs, more precisely the verbs *angreifen*, *anfassen*, and *anlangen*. The goal of this study is to investigate the regional

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variants in question as, for example, the standard-focused *VWB*. For our experiment, we chose to use those verb variants, which were documented both in the *AdA* and the *VWB*.

<sup>5</sup> In general, when we use the term ‘German-speaking area’ in this article, we refer to the so-called *full centres* of the German language area: Austria, Germany, and Switzerland (*VWB*: XXXI).

<sup>6</sup> The question whether German is more suitably described as pluriareal or as pluricentral is still under discussion: a. o. Scheuringer (1996), Glauninger (2003), Kellermeier-Rehbein (2014). For our small-scale study we compare data between the countries Austria, Germany and Switzerland; future research with larger sample sizes might deliver results in favour of one of these approaches.

<sup>7</sup> Among other smaller German-speaking areas.

variation of motor concepts with regard to different speaker groups as well as different verbs.

In the experiment we used the selected ‘touch’ verbs as stimuli in combination with three different objects (a ball, a cup, and a plate) to elicit ‘touch’ movements of 25 native speakers of German from Austria, Germany, and Switzerland. This research design allowed us to investigate fine semantic differences, visible in the differences between the hand movements when the different verbs, regions and object affordances are taken into consideration. Our research questions are the following:

- Are there overall differences in the motor concepts of the verbs *anfassen*, *angreifen*, *anlangen*?
- Are there differences in the motor concepts between speakers from Austria, Germany and Switzerland with regard to *anfassen*, *angreifen*, *anlangen*?
- Which differences exist in the affordances of the objects that are touched by the participants?

The paper is structured as follows: Firstly, we will present the pluriareal data from the *AdA* and *VWB*, on which we base our experiment as well as our hypotheses (Section 2). In Section 3 we will present the methodology, followed by the presentations of the results and their interpretation (Section 4). The conclusion and outlook of future research will follow in Section 5.

## 2 Analysis of existing data

For an initial analysis of the already existing data we consulted the linguistic online mapping project *Atlas zur deutschen Alltagssprache (AdA)* [Online atlas of colloquial German] as well as the dictionary project *Variantenwörterbuch des Deutschen (VWB)* [Dictionary of variants in German] to get a comprehensive overview of the verbs’ regional distribution (2.1) and a detailed semantic description (2.2).

### 2.1 Regional distribution

The *AdA* maps the distribution of verb variants for ‘touching an object’ in colloquial German<sup>8</sup> in Austria, Germany and Switzerland. They presented

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<sup>8</sup> *Alltagssprache* or *Umgangssprache*, i. e. *colloquial language* are terms that have been widely discussed in the research literature (partly due to their vagueness and the difficulty to find useful definitions) e. g. Menge (1982), Stickel (1997), Dittmar (2004). Elspaß and Möller (2003ff.:

an assignment (1) in that somebody is not to be supposed to touch something which led to the resulting map in Figure 1:

(1) “\_\_\_\_\_ *das nicht an!*” [Do not \_\_\_\_\_ it!] (*AdA*: round 3)

While *anfassen* is distributed all over Germany (but seems less frequent in the south), *anlangen* occurs in the south of Germany as well as in Switzerland; *angreifen* is confined to Austria.<sup>9</sup> In the northwest of Germany and in the western part of German-speaking Switzerland, occurrences of *anpacken* and *anlängen* are documented, respectively.

### Figure 1 should be placed here

Figure 1: ‘Touch’-related variants as mapped by *AdA* [Atlas of Colloquial German], Elspaß and Möller (2003ff.: round 3)

A source that documents the selected verbs’ regional distribution on a standard variety level (as opposed to the focus on the colloquial variety in the *AdA*) is the *VWB*. It defines the verbs’ ‘touch’ meaning as follows: “*berühren, ergreifen, [fest] in die Hand nehmen*” [to touch, to grasp, to (firmly) take sth. in one’s hand]. The regional distribution of the ‘touch’ meaning is the following:

- *anfassen*: “CH D (ohne südost)” [Switzerland, Germany (without south east)]
- *angreifen*: “A D-südost” [Austria, Germany (south east)]
- *anlangen*: “CH D-süd” [Switzerland, Germany (south)]

While *anfassen* occurs in the entirety of Switzerland and Germany except for Germany’s south-eastern part (i. e. without Bavaria), *angreifen* occurs in Austria and South-Eastern Germany (i. e. Bavaria). *Anlangen* occurs in Switzerland as well as in the southern part of Germany (i. e. Bavaria and Baden-Wuerttemberg).

With regard to the regional distribution, both sources, *AdA* and *VWB*, overlap to a large degree; the *VWB* locates *anfassen* on the level of the written standard language also in Switzerland and *angreifen* in south-east Germany, which the *AdA* does not map as a primary variant for colloquial German. For our experiment it is important to note that *angreifen* seems to be almost exclusively the preferred variant in Austria; *anlangen* – and

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*Startseite*) define the term for the *AdA* as the “normalen, ortsüblichen Sprachgebrauch” [normal, customary use of language in a certain place].

<sup>9</sup> This distribution only refers to the ‘touch’ meaning of the three verbs. All verbs under investigation are polysemous (cf. Section 2.2 for a more detailed description) and have each specific additional meanings that range from ‘arriving somewhere’ to ‘attacking somebody’ with different regional distributions.

respectively its phonological variant *anlängen* – seem to be the almost exclusively preferred variants for Switzerland; whereas in Germany *anfassen* is the most prominent variant.

## 2.2 Semantic description

From a compositional semantics point of view these three verbs differ, as they consist of the verb particle *an-* and of different stems of the following verbs:

- *fassen*: “mit der Hand an eine bestimmte Stelle greifen, anfassend berühren” [to touch with the hand at a certain spot, to contact by touching] (Duden Online)
- *greifen*: “ergreifen, [in die Hand] nehmen, packen” [to seize, to take (with one’s hand), to grasp] (Duden Online)
- *langen*: “irgendwohin mit der ausgestreckten Hand kommen, mit der Hand erreichen” [to attain something by the outstretched arm, to reach with the hand], “mit der Hand packen, ergreifen; nehmen, holen” [to grab, to seize, to take, to fetch sth. with the hand] (Duden Online)

*An* can be translated as the ‘direction towards’ the object (cf. Duden 2009: 465, para. 821). The status of the morpheme *an-* in *anfassen*, *angreifen* and *anlangen* is a productive verb particle: It is syntactically separable, when the rest of the verb is raised in verb second position (C°) in German main clauses (2).

- (2) *Sie fasst den Becher an.*  
She touches.2.SG.PRESENT the cup towards.PART  
‘She touches the cup.’

In addition to the ‘touch’ meaning of the verbs, there are also other readings listed in the *VWB*: while *anfassen*, for example, can also mean ‘to start something’ or ‘to handle something in a certain way’, *angreifen* can mean ‘to attack something or someone’. *Anlangen* is used to express ‘to arrive at a destination’ or ‘to concern somebody’ (cf. *VWB*). This shows that the verbs are documented as quite polysemous with regard to their semantic range, but overlap with regard to their ‘touch’ meaning, which is the interest of our study.

*AdA* and *VWB* propose *anfassen*, *angreifen* and *anlangen* to be synonyms with regard to their ‘touch’ meaning: The *AdA* suggests that they can all complete the imperative in (1). The *VWB* provides the same semantic description for all three verbs: “berühren, ergreifen, (fest) in die Hand nehmen” [to touch, to grasp, to (firmly) take sth. in one’s hand]. Both

sources treat them as semantically equivalent variants used in different regions of German; the *VWB* gives evidence of this from local newspapers:

- *Sie brachten ihr den Schnee ins Zimmer. Die Frau freute sich, fasste ihn an und sagte: „Oh, kalt, ist das kalt.“ (Märkische Allgemeine 11.7.2012; D) [...] – [They brought snow to her room. The woman was glad, touched it and said: “Oh, cold, it is so cold.”]*
- *Was uns auf der Welt etwas wert ist, ist immer noch haptisch definiert. Das heißt, man muss es angreifen können (News 24.5.2012, 43; A) [...] – [Something that is valuable to us is still defined by haptics. This means it has to be touchable.]*
- *Eine Menge Gedankenarbeit ging voraus, bevor er nur einmal einen Bleistift angelangt hat (BaZ 28.2.2004; CH) [...] – [A lot of mental effort was spent before he touched a pencil only once.]*

### 2.3 Hypotheses

Because of differences in verb stems, the semantic range and the fact that the primary ‘touch’ verb is a different one in each country, we suspect that the presentation of the verbs as synonyms is not fully appropriate: we therefore hope to find (at least fine-grained) differences even in the motor concepts of the three verbs. We state the following hypotheses:

- H1 (motor concepts): There are differences (across regions and objects) in the motor concepts of *anfassen*, *angreifen*, *anlangen*.
- H2 (affordances): There are object-specific motor differences across regions within the concepts of *anfassen*, *angreifen*, *anlangen* among German speakers of Austria, Germany and Switzerland.
- H3 (variation): There are region-specific differences (across objects) between the motor concepts of *anfassen*, *angreifen*, *anlangen*.

## 3 Methodology

In this section we will present the sample of participants, the technical setup and describe the experiment procedure and the applied methods for the data analysis.

### 3.1 Participants

In Mai and June 2015 we tested 25 healthy, right-handed participants with no visual limitations (normal visual acuity, no colour-blindness) native German speakers (11 Austrians, 6 Swiss, and 8 Germans). For a map of

participants' location of language socialization see Figure 2. There were 12 male and 13 female participants aged 20–65 years ( $\bar{X}$  32.8 years) with a mostly academic background. They were found among colleagues, friends and through an online announcement among students at the department of German at the University of Vienna. Through the use of an online questionnaire<sup>10</sup> we were also able to identify, in which German speaking country the participants were mainly culturally socialized (i. e. where they had spent most of their life).

### **Figure 2 should be placed here**

Figure 2: Map of participants' location of language socialization<sup>11</sup> in the countries Austria, Germany and Switzerland (map created with <<https://www.regionalsprache.de>>, based on the classification of German dialects by Wiesinger 1983)

### *3.2 Technical setup*

The participants took part in a hand-object interaction task. Three objects were placed on a table in front of a screen, so that the participants could easily reach them with their right hand: A white plastic cup (200ml) to the left, an orange juggling ball (130g) in the middle and to the right a digital scale *ON-PO5* (1000g x 0.1g); of these, the participants had to touch solely the plate (cf. Figure 2). All instructions and stimuli were displayed on a monitor *Dell 1907FPf* (screen diagonal 48cm) with the software *Open Sesame*<sup>12</sup>. After each 'touch' action the participant's right hand had to go back to resting position on a mouse *Ednet NB Wireless Optic Mouse Nano* in front of them. By double-clicking, the participants could initiate the next stimulus. The hand-object interactions were filmed by two HD camcorders *Canon Legria HF20* on tripods to the left and to the right of the table, so that the screen, the hand and the objects could be filmed from two sides (cf. Figure 3). All items were placed on position stickers fixed to the table surface and to the ground to ensure the same condition for each participant.

### **Figure 2 should be placed here**

Figure 3: Schematic representation of the technical setup: the participant is facing the three objects (CUP, BALL, PLATE) and the monitor, holding the hand in resting position (cross); two cameras are filming the behavior from the left and from the right.)

### *3.3 Experiment procedure*

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<sup>10</sup> We used the survey tool [www.soscisurvey.de](http://www.soscisurvey.de) (accessed 8 December 2015).

<sup>11</sup> The participants' locations where they had acquired their first language and lived for most of their lives.

<sup>12</sup> Version 3.0.0 for *Linux*; Mathôt, Schreij and Theeuwes (2012).

The participants were given written instructions on the screen. They were instructed to carry out all ‘touch’ actions with their right hand; and they were advised to place their left hand on their thigh for the time of the experiment. They could choose a sitting position where they could comfortably reach the mouse and all objects. They were told to sit in an upright position and to preferably move only their right arm and hand. We introduced them to the program and the objects. They were told that stimuli sentences were instructions that told them with which object they had to interact in what way.

To start the experiments participants had to press the left mouse button, then a fixation cross appeared on the screen for 1000ms. Then, after a delay of 500ms, the stimulus was presented. It consisted of the name of the target object followed by the infinite form of the verb stimulus (3). This order resembles the surface structure of infinite German request statements as often used on public signs and plates (4) as reported by the Duden (2009, para. 794):

- |     |                               |     |                                |
|-----|-------------------------------|-----|--------------------------------|
| (3) | <i>Ball</i> <i>angreif-en</i> | (4) | <i>Langsam</i> <i>fahr-en!</i> |
|     | ball touch-INF                |     | slowly drive-INF               |
|     | ‘Touch the ball.’             |     | ‘Drive slowly!’                |

After performing the respective action, the participant could end the turn and start a new one by double clicking the left mouse button. We had a randomized training condition with 2 ‘touch’ verbs *angrapschen* and *antippen* in 3 object conditions each (cup, ball, plate). During and after the training condition a supervisor was present: participants could ask questions and were monitored. Then the main experiment started. It consisted of 24 randomized stimuli: We presented 8 ‘touch’ verbs: 3 goal stimuli *anfassen*, *angreifen*, *anlangen* and 5 distraction stimuli: *anlängen*, *anstipsen*, *anstupsen*, *anpacken*, *anpicken* in 3 object conditions (cup, ball, plate) each. In the post-experiment online questionnaire<sup>13</sup>, the participants were asked for a short description of the verb meanings for *anpacken*, *anlangen*, *anfassen*, *anlängen*, *anpicken*, *angreifen*, *anstupsen* and *anstipsen* in their own words. We wanted to check for subjective differences in verb meanings according to the participants’ experiences in the experiment. We expected description differences in gripping behavior regarding (a) contact points, between hand and objects (for example finger TIP vs. finger BALL vs. finger ROOT) and (b) object handling (CONTROL).

On a new page they should give a rating for the ‘touch’ intensities they had applied to the objects. They were given a 7-point scale with the extreme poles *low intensity* and *high intensity*. This task was designed to evoke

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<sup>13</sup> With the survey tool [www.soscsurvey.de](http://www.soscsurvey.de) (accessed 8 December 2015).

subjective descriptions regarding (c) the applied gripping force resulting in potential object deformation (DEFORM).

### 3.4 *Method of analysis*

For the analysis, we focused on the videos from camera 1 on the left side, as the contact points between object and hand could be clearly observed from this perspective. On the whole, we extracted 225 ‘touch’ scenes from all 25 participants, which comprised all ‘touch’ actions for the three target verbs *anfassen*, *angreifen*, *anlangen* in all three object conditions (cup, ball, plate). We categorized and assorted them by stimuli and carried out a visual video analysis (motion categorization by 2 explorers) and a quantitative analysis. The videos of the right camera were consulted only in a small number of ambiguous cases. In the following, we present the criteria for the categorization.

#### 3.4.1 *Manner of CONTACT*

Regarding the hypotheses (see Section 2.3), we wanted to know if participants’ motor behavior differed with respect to the areas of contact of the right hand during the ‘touch’ actions. We investigated two fingers more closely as points of contacts and analyzed if the objects were touched with (a) the finger TIP, (b) the finger BALL or (c) the finger ROOT. We also analyzed if the OTHER fingers were contacting the respective object (cf. Figure 4).

**Figure 4 should be placed here.**

Figure 4: Finger areas that were involved in the contact behavior (TIP, BALL, ROOT) for thumb, index finger and OTHER fingers involved.

#### 3.4.2 *Object DEFORMATION*

The category DEFORM enabled us to analyze if there was a difference in the force that was applied to the object. Clearly visible deformation (cf. Figure 5) of objects was classified as +DEFORM. No visible deformation was classified as –DEFORM.

**Figure 5 should be placed here.**

Figure 5: Objects that had been deformed were categorized as +DEFORM.

Deformations could be quite easily detected in the (color) video, because of changes in the surface structure and in color/shading.

#### 3.4.3 *Object CONTROL*

If participants strongly controlled the object by their ‘touch’ action so that they were (potentially) able to lift the object in the actual hand configuration, they were categorized as +CONTROL (cf. Figure 6: left). Some participants actually lifted objects. Those postures in which it was impossible to lift an object were categorized as –CONTROL (cf. Figure 6: right).

**Figure 6 should be placed here.**

Figure 6: Objects that had been strongly controlled so that they could potentially be lifted, were categorized as +CONTROL (left picture), others as –CONTROL (right picture).

#### 3.4.4 Behavioral DELAY

According to the onset of the stimulus presentation we looked for a DELAY in object interaction (>2 sec) and hesitation gestures<sup>14</sup>, which we interpreted as indications for possible conceptual difficulties either in planning and applying the known motor concept to the particular object (affordance mismatch), or in having no discrete motor concept for the particular verb.

**Figure 7 should be placed here.**

Figure 7: As hesitation gestures (+DELAY), we categorized those motor actions which did not follow a direct trajectory from the source (mouse) to the object (goal position).

## 4 Results

In this section we present the results (a) from the pre-experiment questionnaire investigating participants’ preferred verb variants, (b) from the experiment testing general and regional differences in motor concepts for the verbs *anfassen*, *angreifen* and *anlangen* and (c) from the post-experiment questionnaire investigating ‘touch’-intensity judgements and the participants’ semantic descriptions of the three verbs. After this, the hypotheses (from Section 2.3) will be evaluated.

### 4.1 Preferred verb variants

As a first step, it was tested if the participants in our sample matched the results from the *AdA* in Figure 1. As part of the pre-experiment questionnaire, the informants were asked to indicate their preferred ‘touch’-verb variant (cf. the assignment in Elspaß and Möller 2003ff.: round 3).

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<sup>14</sup> These included abrupt halts of the ‘touch’ movement (hesitation before starting the hand movement or touching the object) and deviations from a direct trajectory of the hand (position and form) between resting position and goal object.

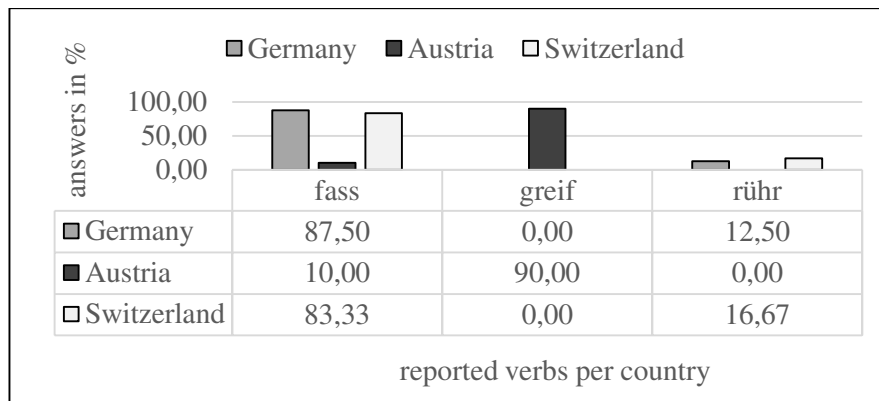


Figure 8: Results in % for preferred ‘touch’-verb variants per country regarding (1) (Somebody is not supposed to touch something! – What do you say?: Do not \_\_\_\_\_it!).<sup>15</sup>

Surprisingly, none of our Swiss participants reported *anlangen* as their preferred variant, but tended to use *anfassen*, which deviates from the *AdA* map in Figure 1 and the entry in the *VWB*. The distribution of *anfassen* in Germany and *angreifen* in the Bavarian dialect area in Austria coincides with the data from the *AdA* and the *VWB*.

#### 4.2 Results for H1: general differences in motor concepts

Table 1: General differences in the motor concepts of *anfassen* (n=69), *angreifen* (n=67) and *anlangen* (n=72)<sup>16</sup>; percentages of applicable cases.

verbs Ø	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
<i>anfassen</i>	.10	.64	.28	.07	.90	.64	.99	.23	.65	<b>.04*</b>
<i>angreifen</i>	.06	.73	.37	.07	.91	.64	<b>1.00*</b>	.30	.66	<b>.15*</b>
<i>anlangen</i>	.10	.64	.24	.10	.85	.49	<b>.94*</b>	.18	.56	<b>.19**</b>

*Angreifen* seems to be the concept with most ROOT\_THUMB CONTACT (=the most ‘enclosing’ concept). *Angreifen* has also the highest value for DEFORM, i. e. applying the most pressure. *Anlangen* seems to make least use of ROOT\_THUMB / ROOT\_INDEX CONTACT as well as of DEFORM and CONTROL applied to objects. Due to the lowest DELAY time, *anfassen* seems to be the concept that is best known or best compatible with the objects:

<sup>15</sup> Among the Austrian speakers, there was one indication of the verb *tu* ‘do’ which in this context functions only as an auxiliary, a corresponding ‘touch’ verb was missing, which is why this answer is not considered in the data.

<sup>16</sup> Under the following conditions there was a significant difference in the independent samples t-test scores for:  
 OTHER: *angreifen* (M=1,00, SD=0,00), *anlangen* (M=0,94, SD=0,23); df (71)=2,044, p=0,045.  
 DELAY: *anfassen* (M=0,04, SD=0,21), *angreifen* (M=0,15, SD=0,36); df (134)=-2,166, p=0,036.  
 DELAY: *anfassen* (M=0,04, SD=0,21), *anlangen* (M=0,19, SD=0,40); df (139)=-2,809, p=0,006.

- object CONTACT of ROOT\_THUMB: *angreifen* > *anfassen* > *anlangen*
- object CONTACT of ROOT\_INDEX / OTHER FINGERS: *angreifen* / *anfassen* > *anlangen*
- object DEFORMATION: *angreifen* > *anfassen* > *anlangen*
- object CONTROL: *angreifen* / *anfassen* > *anlangen*
- object-concept-COMPATIBILITY: *anfassen* > *angreifen* > *anlangen*.

#### 4.3 Results for H2: affordances – differences between the objects

Table 2: Differences in affordances of the objects BALL (n=72), CUP (n=69) and PLATE (n=67) for the ‘touch’-verb conditions<sup>17</sup>; percentages of applicable cases.

objects (Ø)	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
BALL	.11	.88	<b>.47*</b>	.10	.86	<b>.75*</b>	.97	<b>.25*</b>	.89	.06
CUP	.10	.84	<b>.29*</b>	.06	.93	<b>.55*</b>	.97	<b>.45*</b>	.90	.06
PLATE	.04	.27*	<b>.10**</b>	.09	.87	<b>.45**</b>	.99	<b>0.00**</b>	.04**	.28**

The three objects clearly differ in affordances (how they are to be interacted with): in terms of CONTACT (cf. Figure 5) the ball most affords to be contacted with the root of the thumb (Ø: ball 0.47\*; cup 0.29\*; plate 0.10\*\*) and of the index finger (Ø: ball 0.75\*; cup 0.55\*; plate 0.45\*\*), followed by the cup with intermediate contact values and by the plate with little values. – Regarding DEFORMATION the values are as expected: the plate (made of aluminium) cannot be deformed in any way (Ø: 0.00\*\*); the ball is also quite solid and thus it is harder to deform it (Ø: 0.25\*) than the cup made of light plastic (Ø: 0.45\*). Furthermore, as expected, the plate cannot be controlled by the hand easily (Ø: 0.04\*\*). Remarkably, the concepts of the three ‘touch’ verbs must be in part incompatible with flat

<sup>17</sup> Under the following conditions there was a significant difference in the independent samples t-test scores for:

ROOT\_THUMB: *ball* (M=0,47, SD=0,50), *cup* (M=0,29, SD=0,46); df (138,62)=2,256, p=0,026.  
 ROOT\_INDEX: *ball* (M=0,75, SD=0,44), *cup* (M=0,55, SD=0,50); df (134,613)=2,515, p=0,013.  
 DEFORM: *ball* (M=0,25, SD=0,44), *cup* (M=0,45, SD=0,50); df (134,613)=-2,515, p=0,013.  
 BALL\_THUMB: *ball* (M=0,88, SD=0,33), *plate* (M=0,27; SD=0,45); df (121,689)=9,021, p=0,000.  
 ROOT\_THUMB: *ball* (M=0,47, SD=0,50), *plate* (M=0,10, SD=0,31); df (119,040)=5,239, p=0,000.  
 ROOT\_INDEX: *ball* (M=0,75; SD=0,44), *plate* (M=0,45, SD=0,50); df (131,227)=3,782, p=0,000.  
 DEFORM: *ball* (M=0,25, SD=0,44), *plate* (M=0,00, SD=0,00); df (71,000)=4,865, p=0,000.  
 CONTROL: *ball* (M=0,89, SD=0,32), *plate* (M=0,04, SD=0,21); df (123,685)=18,693, p=0,000.  
 DELAY: *ball* (M=0,06, SD=0,23), *plate* (M=0,28, SD=0,45); df (96,332)=-3,691, p=0,000.  
 BALL\_THUMB: *cup* (M=0,84, SD=0,37), *plate* (M=0,27, SD=0,45); df (127,903)=8,131, p=0,000.  
 ROOT\_THUMB: *cup* (M=0,29, SD=0,46), *plate* (M=0,10, SD=0,31); df (119,583)=2,781, p=0,000.  
 DEFORM: *cup* (M=0,45, SD=0,50), *plate* (M=0,00, SD=0,00); df (68,000)=7,448, p=0,000.  
 CONTROL: *cup* (M=0,90, SD=0,30), *plate* (M=0,04, SD=0,21); df (120,599)=19,146, p=0,000.  
 DELAY: *cup* (M=0,06, SD=0,24), *plate* (M=0,28, SD=0,45); df (98,428)=-3,621, p=0,000.

surfaces, as the higher delay values for plate ( $\emptyset$ : 0.28\*\*) show. It seems that some relevant semantic aspects of ‘enclosing’ or ‘controlling’ an object, which are impossible when touching the plate, are part of the ‘touch’-verb semantics.

- CONTACT of ROOT\_THUMB / ROOT\_INDEX: BALL > CUP > PLATE
- grade of DEFORMATION: CUP > BALL > PLATE
- grade of concept COMPATIBILITY with object: BALL / CUP > PLATE

#### 4.4 Results for H3 (variation): regional differences in motor concepts between countries

Table 3: General differences in motor concepts between speakers from Austria (A, n=30), Switzerland (CH, n=15), Germany (D, n=24) across all verb concepts<sup>18</sup>; percentages of applicable cases.

countries ( $\emptyset$ )	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
A	<b>.04*</b>	<b>.75*</b>	<b>.42**</b>	.06	.88	<b>.73**</b>	.97	.30	.65	.14
CH	<b>.14*</b>	.63	<b>.12**</b>	.10	.92	<b>.47**</b>	1.00	.18	.67	.06
D	.10	<b>.59*</b>	<b>.25*</b>	.10	.87	<b>.49**</b>	.97	.19	.54	.16

With reference to all verbs, the participants from Austria tend to enclose objects more with their fingers (highest values for contact of ROOT\_THUMB / ROOT\_INDEX with objects) than Germans and Swiss. They also tend to apply the most pressure while touching objects, because they have the highest DEFORMATION scores. Germans tend to CONTROL objects least while touching them.

##### 4.4.1 Variation per country in the concept of anfassen

Table 4: Differences in motor concepts between the countries Austria (A, n=30), Switzerland (CH, n=15), Germany (D, n=24) for *anfassen*<sup>19</sup>; percentages of applicable cases.

<sup>18</sup> Under the following conditions there was a significant difference in the independent samples t-test scores for:

ROOT\_THUMB: A (M=0,42, SD=0,496), CH (M=0,12, SD=0,331); df (131,574)=4,199, p=0,000.  
 ROOT\_INDEX: A (M=0,73, SD=0,449), CH (M=0,47, SD=0,504); df (89,052)=2,974, p=0,004.  
 BALL\_THUMB: A (M=0,75, SD=0,437), D (M=0,59, SD=0,496); df (133,798)=2,104, p=0,037.  
 ROOT\_THUMB: A (M=0,42, SD=0,496), D (M=0,25, SD=0,436); df (152,801)=2,260, p=0,025.  
 ROOT\_INDEX: A (M=0,73, SD=0,449), D (M=0,49, SD=0,503); df (134,811)=3,133, p=0,002.

<sup>19</sup> Under the following conditions there was a significant difference in the independent samples t-test scores for:

ROOT\_THUMB: A (M=0,43, SD=0,504), CH (M=0,00, SD=0,00); df (29)=4,709, p=0,000.  
 ROOT\_INDEX: A (M=0,87, SD=0,346), CH (M=0,47, SD=0,516); df (20,482)=2,711, p=0,013.

countries (Ø)	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
A	.03	.77	<b>.43**</b>	.03	.93	<b>.87**</b>	.97	.27	.70	.07
CH	.20	.53	<b>0.00**</b>	.07	.93	<b>.47**</b>	1.00	.20	.67	0.00
D	.13	.54	<b>.25*</b>	.13	.83	.46	1.00	.21	.58	.04

Austrians conceptualize *anfassen* most strongly with enclosing an object with the fingers (high values for ROOT\_THUMB / ROOT\_INDEX). For German and Swiss speakers *anfassen* includes more contact of TIP\_THUMB and TIP\_INDEX than for Austrians. *Anfassen* is the verb with least delay time and thus the most common concept in all three countries.

#### 4.4.2 Variation per country in the concept of angreifen

Table 5: Differences in motor concepts between the countries Austria (A, n=29), Switzerland (CH, n=17), Germany (D, n=21) for *angreifen*<sup>20</sup>; percentages of applicable cases.

countries (Ø)	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
A	0.00	.79	.45	0.00	.93	<b>.79*</b>	1.00	.34	.66	.10
CH	.12	.71	.24	.12	.94	<b>.47*</b>	1.00	.24	.71	.06
D	.10	.67	.38	.14	.86	.57	1.00	.29	.62	.29

For Austrian and German speakers, *angreifen* is a concept that includes the bending of the fingers, i. e. of enclosing objects (high values for ROOT\_THUMB / ROOT\_INDEX) than for Swiss. According to DELAY time, the concept is less common for Germans.

#### 4.4.3 Variation per country in the concept of anlangen

Table 6: Differences in motor concepts between the countries Austria (A, n=32), Switzerland (CH, n=17), Germany (D, n=23) for *anlangen*<sup>21</sup>; percentages of applicable cases.

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ROOT\_INDEX: A (M=0,87, SD=0,346), D (M=0,46, SD=0,509); df (38,910)=3,359, p=0,002.

ROOT\_THUMB: CH (M=0, SD=0,000), D (M=0,25, SD=0,442); df (23)=-2,769, p=0,011.

<sup>20</sup> ROOT\_INDEX: A (M=0,79, SD=0,412), CH (M=0,47, SD=0,516); df (28,040)=2,203, p=0,36.

<sup>21</sup> Under the following conditions there was a significant difference in the independent samples t-test score for: ROOT\_THUMB: A (M=0,38, SD=0,492), D (M=0,13, SD=0,344); df (52,980)=2,169, p=0,035.

countries (Ø)	THUMB			INDEX FINGER			OTHER	DEFORM	CONTROL	DELAY
	TIP	BALL	ROOT	TIP	BALL	ROOT				
A	.09	.69	.38*	.13	.77	.53	.94	.28	.59	.25
CH	.12	.65	.12	.12	.88	.47	1.00	.12	.65	.12
D	.09	.57	.13*	.04	.91	.43	.91	.09	.43	.17

*Anlangen* differs in ROOT-THUMB contact between Austrians (.38\*) and Germans (0.13\*). Most remarkably, for Germans it seems to be a motor concept that results less in object CONTROL than it does for Austrian and Swiss German speakers. Austrians seem to apply more pressure (DEFORM).

#### 4.5 Semantic descriptions

In addition to measuring the differences in ‘touch’-verb concepts, we asked the participants for semantic descriptions of the verbs cropping up in the experiment. For each verb we asked in the questionnaire: What does the verb mean in your opinion? Please write down a short description in your own words.

A lot of our participants described *anfassen*, *angreifen*, *anlangen* as synonyms for ‘touch’ or ‘gripping’ actions. *Anfassen* was known and described by all participants; one Swiss person categorized it as the variant that is closer to the standard variety:

- *Das gleiche wie anlangen nur einfach Hochdeutsch* [The same as *anlangen* but in standard German] (Schwyz, CH)

Some of the Germans and the Austrians described *anlangen* as a variant that is unknown to them or not part of their variety (n=5/19):

- *Nicht in meinem aktiven Wortschatz, aber im Sinne von 'mit der Hand umschließen' verstanden.* [Not in my active vocabulary, but understood it in the sense of ‘enclose with the hand’] (Neumarkt/Ybbs, A)

The Germans (n=4/8) and the Swiss (n=2/6) however described *angreifen* in the primary interpretation as a concept of ‘attacking’ which none of the Austrians (n=0/11) mentioned:

- *Österreichisch für anfassen; für mich attackieren!* [Austrian for *anfassen*; for me: to attack!] (München, D)
- *wohl dasselbe wie „anlangen, anfassen“, also einfach berühren. Aber nicht schweizerisch, also würd ich selbst nur in der Bedeutung „attackieren“ brauchen.* [probably the same as ‘anlangen, anfassen’, i. e.

simply ‘touch’. But not Swiss, I myself would only use it with the meaning ‘to attack’] (Felben-Wellhausen, CH)

#### 4.6 Intensities

In H1, we hypothesized that there would be differences in motor concepts regarding the force applied to an object. As we could not (yet) find objects that enabled us to automatically measure the force that was applied when they were touched, we asked the participants for their assessment on a 7 point scale from *niedrige Intensität* [low intensity] to *hohe Intensität* [high intensity]: “Mit welcher Intensität haben Sie die Objekte berührt? Bewerten Sie die Intensität der folgenden Wörter. [With which level of intensity did you touch the objects? Please judge the intensity of the following words]: *anpacken, anlangen, anfassen, anlängen, anpicken, angreifen, anstupsen, anstipsen.*”

With respect to reported INTENSITY we could find a significant difference between the average value of *anfassen* (4.74\*<sup>22</sup>), *angreifen* (5.04) and *anlangen* (4.58). The trend that *angreifen* is considered as a verb of higher intensity than *anfassen* is evident in the data with regard to countries: The medians for *anfassen* (A: 4.7; CH: 4.17; D: 5.29), *angreifen* (A: 5.09; CH: 4.38; D: 5.17) and *anlangen* (A: 5.27; CH: 3.83; D: 4.14) display an interesting significant difference for *anlangen* between Austrians (MD: 5) and Swiss (MD: 4) (U: 12.5, p=0.035) that coincides with the observation for DEFORM values (see Section 4.3.3).

### 5 Summary and Outlook

As shown in the analyses, there seem to be considerable differences between the ‘touch’ concepts of the verbs investigated. Regarding hypothesis 1 (differences in motor concepts), it could be shown that overall, *angreifen* seems to be the most *enclosing* concept, i. e. the concept with the most ROOT\_THUMB contact. It furthermore possesses the most potential for object DEFORMATION. In contrast, *anlangen* seems to show the least ROOT\_THUMB and INDEX\_CONTACT, as well as the lowest score for CONTROL and DEFORMATION of objects. *Anfassen* causes the lowest time DELAY, which might hint at it being the most commonly known verb overall: The ‘touch’ meaning of *angreifen* is secondary to Germans and Swiss (the primary meaning for them is ‘to attack’); the ‘touch’ meaning of *anlangen* is secondary to Austrians and Germans (the primary meaning for

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<sup>22</sup> One-Sample Kolmogorov-Smirnov Test (D=0,280, p<sub>exact</sub>=0,043).

them is ‘to arrive’); only *anfassen* has a primary ‘touch’ meaning in all countries under investigation.

With regard to hypothesis 2, it can be stated that the objects show considerable differences in their affordances: BALL triggers the most ROOT\_THUMB and ROOT\_INDEX finger contact, PLATE the least THUMB-ROOT-contact and CONTROL. CUP seems to afford the most INDEX\_BALL contact. Not surprisingly, the light CUP affords to be more deformed than the more stable BALL and the solid PLATE. The significantly higher values for PLATE concerning DELAY show that the concepts of *anfassen*, *angreifen* and *anlangen* seem less compatible with flat surfaces that cannot be enclosed while making contact: they seem to comprise an enclosing motor concept component.

For hypothesis 3 (variation), the analysis shows that *angreifen* apparently infers the most DELAY for German speakers (implying that it is less common for German speakers). Austrian participants made the (significantly) highest INDEX\_ROOT contact for this verb concept: for Austrians, in comparison to Swiss and Germans, *angreifen* seems to be more a concept of enclosing an object. *Anlangen* has significantly more ROOT-THUMB-contact for Austrians than for Germans. It seems to be a stimulus that causes less object CONTROL and DEFORMATION for Germans than for Austrian and Swiss speakers: *anlangen* for Germans tends to comprise a higher semantic component of making contact without controlling or deforming the object. For Austrians *anlangen* has the highest DELAY values: it seems to be a less common concept for this group. *Anfassen* differs in the way contact is made with objects: While Austrians tend to use the thumb and the root of the index, German and Swiss speakers also include the tips of both of the fingers. For all three groups the DELAY scores are lower than for the other verbs, which suggests that this concept is the most known and has a ‘touch’ concept as primary meaning in all three countries..

On the whole, considerable differences in motor concepts, affordances and variation could be shown between verbs and regions. Most participants of the three countries had low delay values, indicating that the verb form and a particular concept was known to them. The surprising, significant differences in motor concepts between those known concepts show that the verbs are not synonymous with regard to motor concepts: in each region there seem to be slightly different interpretations of the ‘touch’-verb concepts: *anfassen*, *angreifen* and *anlangen*.

For a more in-depth analysis, future surveys could include a broader sample of informants as well as a control group of rural, non-mobile informants as well include the differentiation between regions within a country (e. g. a group of informants from northern Germany v. from

southern Germany; from western Austria v. from eastern Austria etc.). It could also be controlled for hand size: individual objects sizes could be chosen corresponding to the participants hand size and eye-tracking tests could be run to discover possible cultural differences in eye-hand-object coordination.

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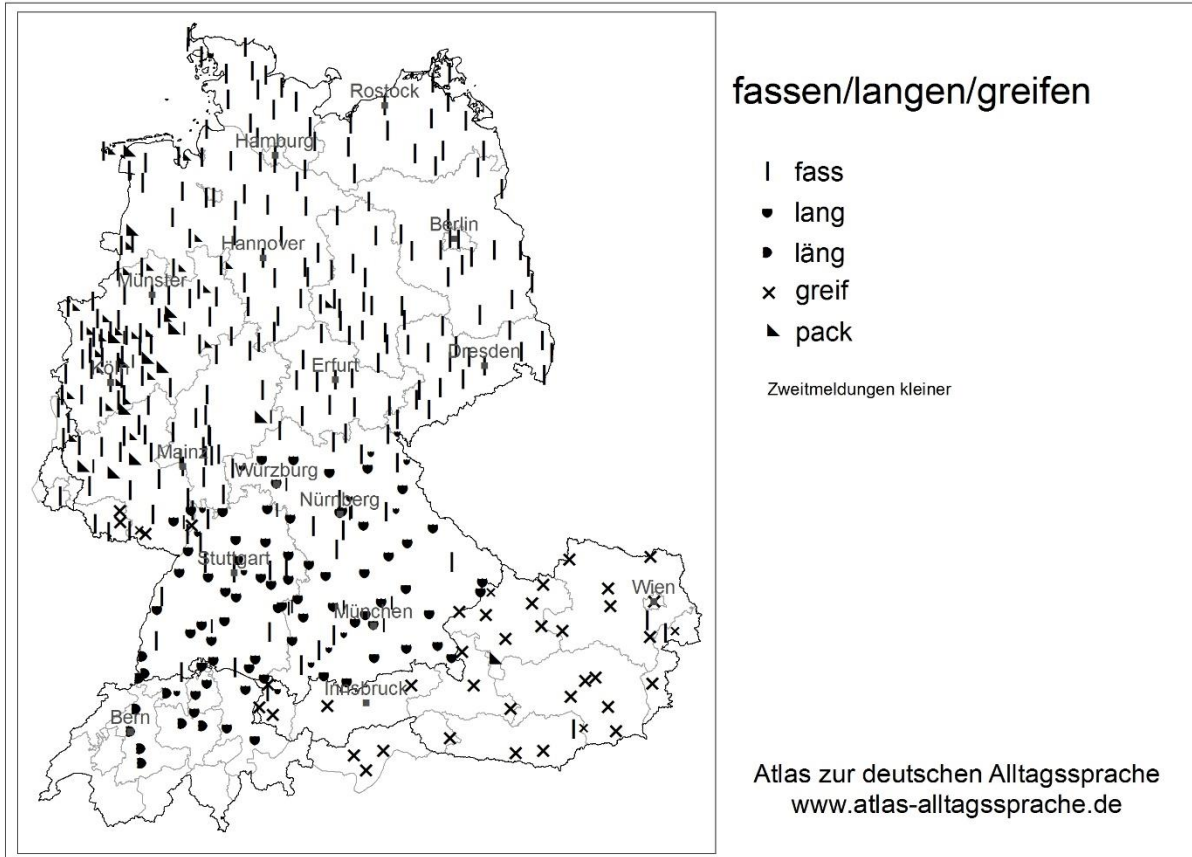
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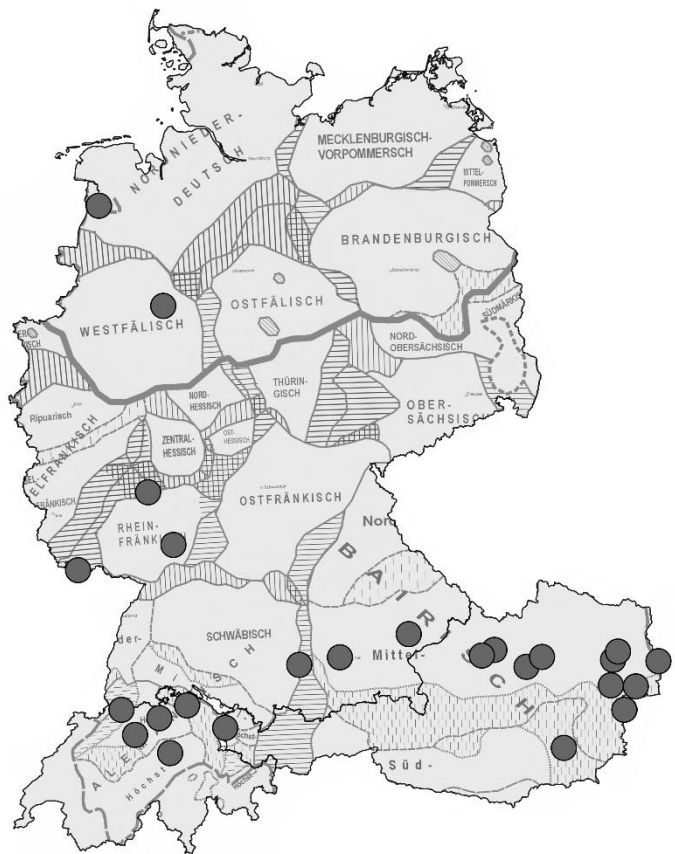
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Figures

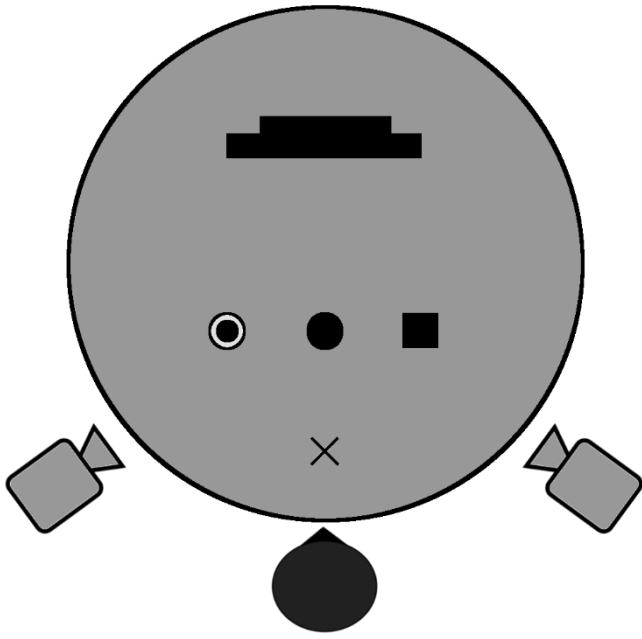
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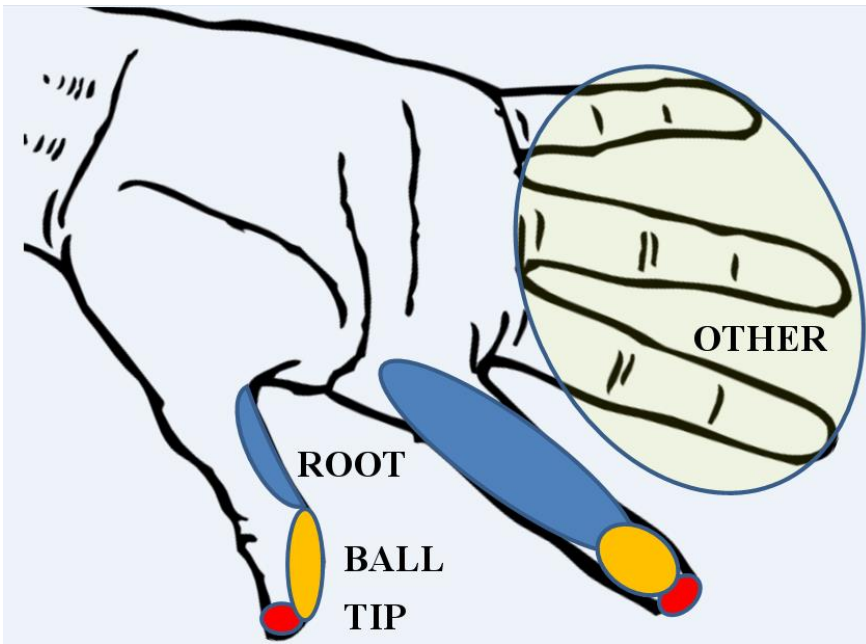
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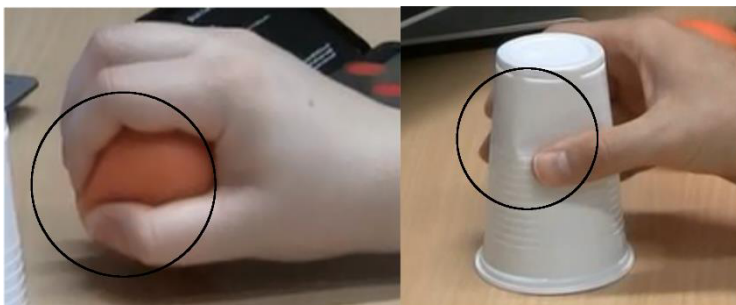
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