Read carefully before/while annotating and validating

Annotation and Validation Guideline

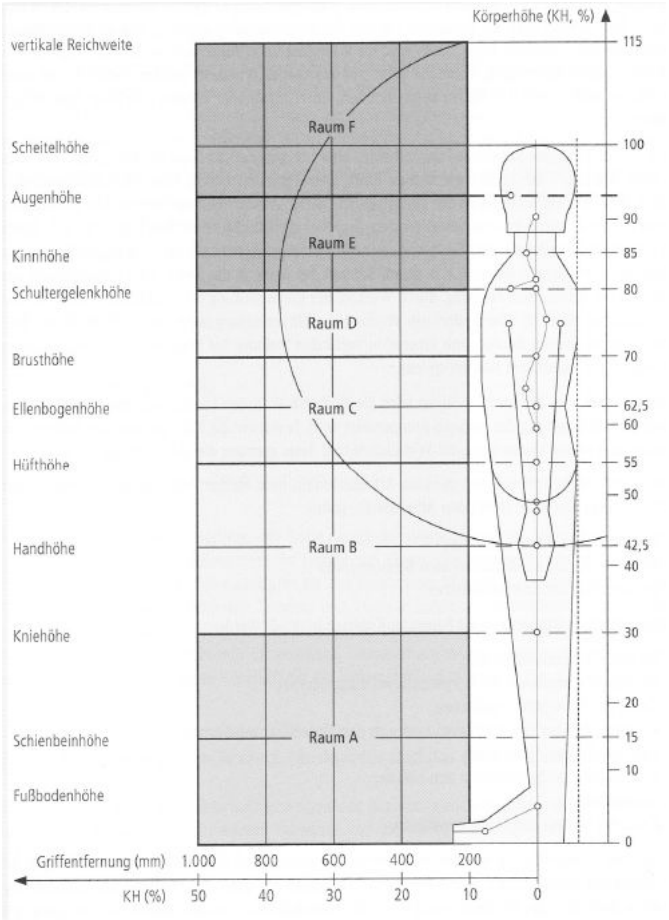
General Information

- Each file has 6 identifiers
    - S Scenario: There are 3 in total. The first is a simple one, the second and third are based on a real warehouse processes and more complex
    - P Proband: There are 14 as of now
    - R Recording: There are 30 recordings of 2min each per proband
    - A Annotator: ID of the person who annotated manually
    - N Number of annotation: How many times did the annotator already annotate this file (relevant for repetition tests regarding the consistency)
    - i iteration of revision/validation: work in progress
- For the recording from 2018-11, there are 30x2min=60min of recording per participant, 6 participants in total resulting in 6h of recordings to be annotated. All recordings are taking place in Scenario I
- For the recording from 2019-08, there are again 60min of recording per participant with 8 participants (8h of recording)
- Recordings are annotated in two ways at the same time: activity-wise und attribute-wise (see below and the google-table called Activities and Attributes for more information)
- We only annotate the MoCap data, IMU data will be synchronized posteriorly for (semi-) automated annotation
- Once the initial, manual annotation is done, we are revising and validating all annotations
- Annotation effort will be documented; this is not a contest who is the fastest!

Activities and Attributes

Activity-wise Annotation

- **c1 Standing:** Standing while not doing any specific action. Smaller steps while standing are still considered standing.
- **c2 Walking:** Gait cycle (see below) while moving to a new position. No difference made in regards to whether something is carried or not. For the class walking, the attribute “gait cycle” is mandatory
- **c3 Cart:** Pushing or pulling the cart to a new position (walking with it) with a single or both hands; does not include the handling of items and boxes on the cart (this is considered handling), does not include handling the cart before putting boxes on it or before pushing/pulling - this is considered a handling activity
  The handling activities refer to a motion of the upper body, not to holding onto something, e. g. when pushing a cart or holding a box while walking. But it refers to handling the cart before or after moving it to a new position



- **c4 Handling (upwards):** At least one of the used hand(s) is/are on the same height as the shoulder joint or higher (Raum E und Raum F within the motion range of the hands) as seen in the image

- **c5 Handling (centred):** Handling is possible without bending over, kneeling or lifting arms to shoulder joint height (Raum B, Raum C and Raum D within the range of the hands) - as it is not possible to lift an item without tilting your spine at all, take the direction of the participant's sight for reference: does he/she look forward or downwards?
- **c6 Handling (downwards):** Legs or back need to be adjusted for handling, e.g. kneeling, bending over etc. Back is tilted to a horizontal line or further

- **c7 Synchronization:** Waving Motion in the beginning of each recording; stops as soon as the participant”s arms are at the lowest point, attention: this activity has a fixed attribute representation (see excel table)
- **c8 None:** Frames that shall not be taken into account, because the activity is not recognisable. Reasons can be unspecified activities, errors/gaps in the recording or when an activity is not recognizable because it is cut by the end each recording

Attribute-Wise Annotation

At least one of the attributes per group I-IV has to be picked! Otherwise, then annotation is invalid!

I. **Legs:** Exclusive Choice since a person can only perform either one of these motions
   A. Gait Cycle: see picture below.
   B. Step: A single step without a foot swing. This can also refer to a step forward, followed by a step backwards using the same foot. A step requires the foot to leave the ground
   C. Standing Still: Both feet stay on the ground

II. **Upper Body:** Exclusive choice between A,B,C,D - Torso Rotation (E) is independent. These attributes refer to a motion of the upper body, not to holding onto something, e. g. when pushing a cart or holding a box while walking.
   A. Upwards: At least one of the used hand(s) is/are on the same height as the shoulder joint or higher (see picture above when activities were explained)
   B. Centred: Handling is possible without bending over, kneeling or lifting arms to shoulder joint height - as it is not possible to lift an item without tilting your spine at all, take the direction of the participant's sight for reference: does he/she look forward or downwards?
   C. Downwards: Legs or back need to be adjusted for handling, e.g. kneeling, bending over etc. Back is tilted to a horizontal line or further
   D. No intentional motion: Default value when no intentional motion is performed, e. g. when standing or walking around without doing anything specific. Also applied when carrying a box or walking with a cart. This is because there is no intentional motion when performing these activities, only a steady stance.
   E. Torso Rotation: see picture below. rotation in the transverse plane. Either a rotating motion, e.g. when taking something from the cart and turning towards the shelf or a fixed position when handling something while the torso is rotated. Torso rotation cannot be used with “gait cycle” at the same time.

III. **Handedness:** Non exclusive choice between right, left or both - otherwise pick *no arms.* Handedness is activated while handling items and also while pushing/pulling the cart, holding an item and so forth.
   A. Right
   B. Left
   C. No Arms

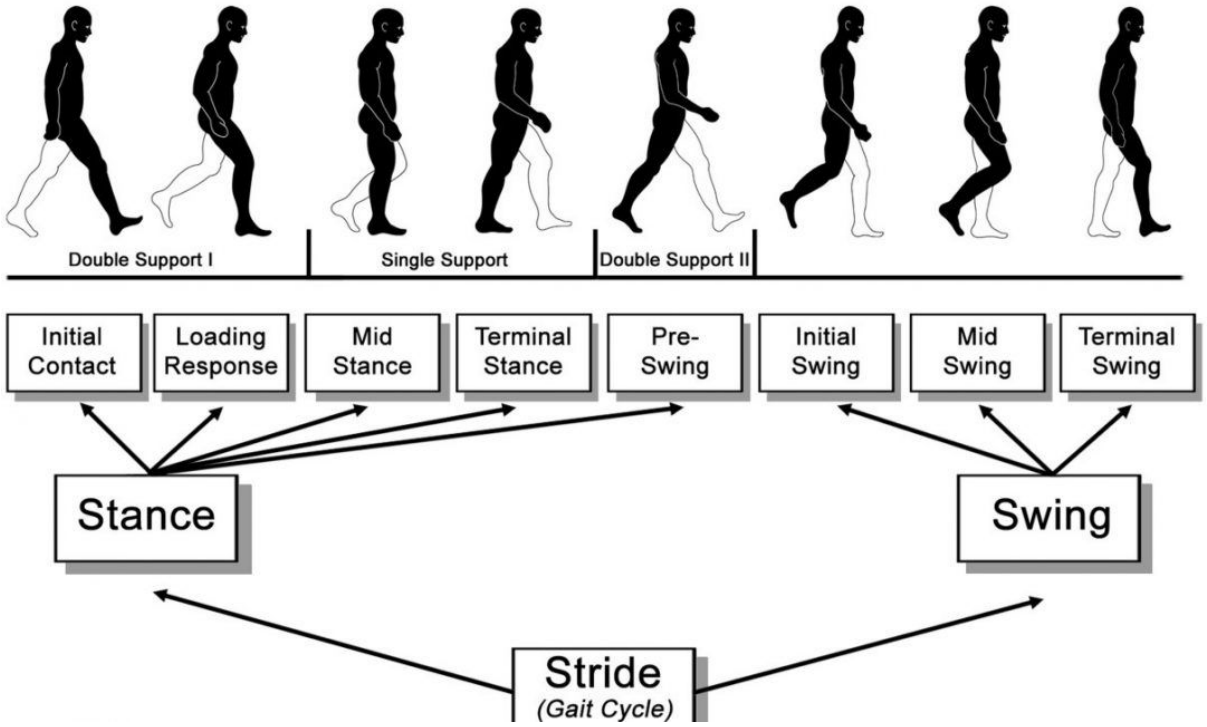
IV. **Item Pose**: Exclusive Choice. In case several items are handled at the same time, choose tool over handy unit over bulky unit over cart
   A. Bulky Unit: Large item that one cannot put his/her hands around, e. g. boxes
   B. Handy Unit: Small item that can be carried with a single hand or that one can put his/her arms around, e. g. the weight sacks
   C. Utility-Aux.: Use of equipment such as scissors, cushions, labels, scanners, stamps, but not computer since this is a separate attribute
   D. Cart: a) Moving the cart to a proper position before taking it to a different location or before putting boxes on it (considered as upper body motion as

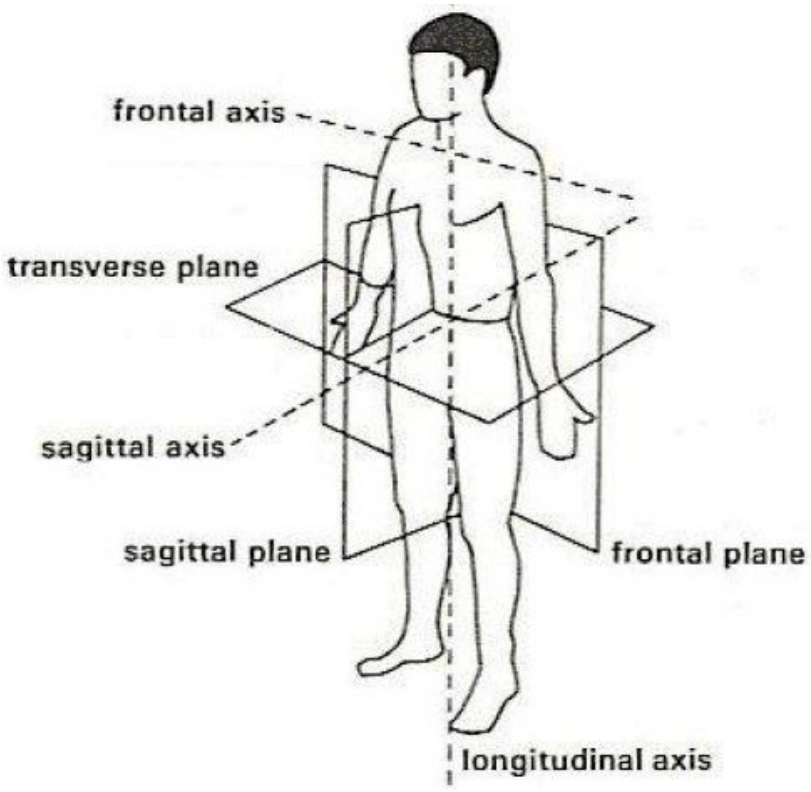
well and therefore class handling), b) Pushing/Pulling the cart to a new location (considered no intentional motion combined with gait cycle and class cart)

E. Computer: using Mouse / Keyboard, reading from the screen
F. No Item: Default value - For activities that do not include any item like plain walking or standing. For example, handling(downwards) with no item is looking into a box positioned on a low level but not taking anything from it.

V. None

A. None: Frames that shall not be taken into account, because the activity is not recognisable. Reasons can be unspecified activities, errors/gaps in the recording or when an activity is not recognizable because it is cut by the end each recording


Double Support I
Single Support
Double Support II
Initial Contact
Loading Response
Mid Stance
Terminal Stance
Pre-Swing
Initial Swing
Mid Swing
Terminal Swing
Stance
Swing
Stride
(Gait Cycle)

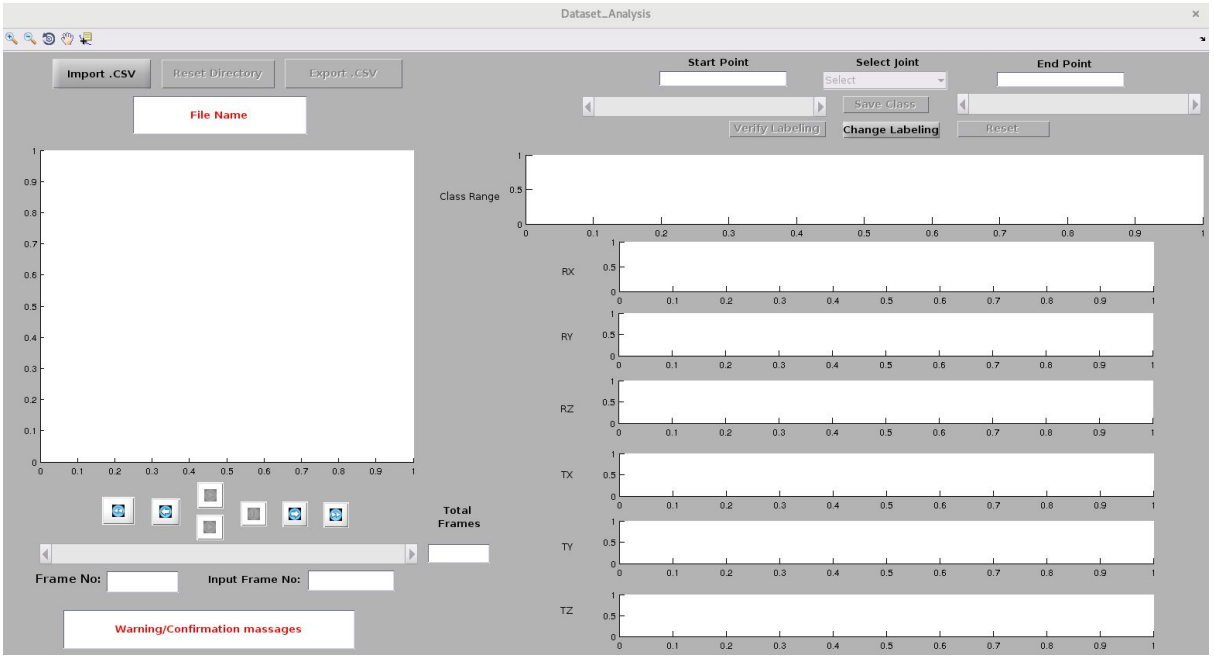

frontal axis
transverse plane
sagittal axis
sagittal plane
frontal plane
longitudinal axis

Annotation Tool

The annotation tool is a matlab script “Dataset_Analysis.m”.

I. Open and run the matlab file “Dataset_Analysis.m”.

The annotation window should be displayed.

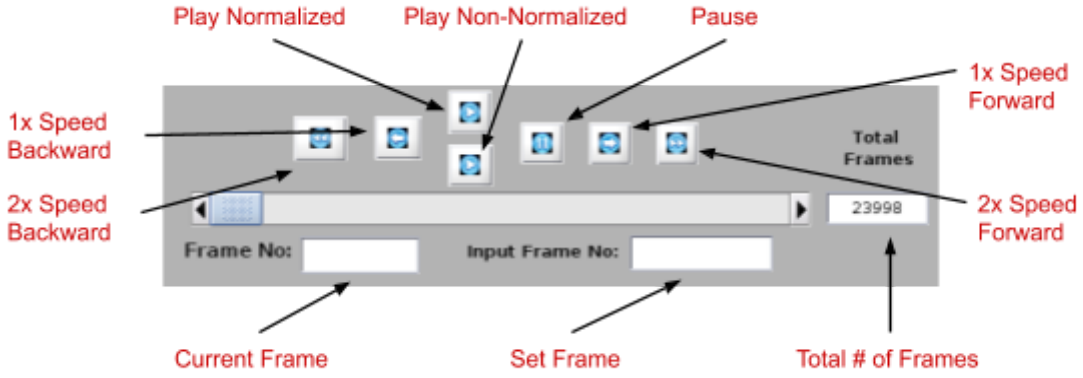


II. Import CSV file. The file should contain the recorded samples from the human segments.

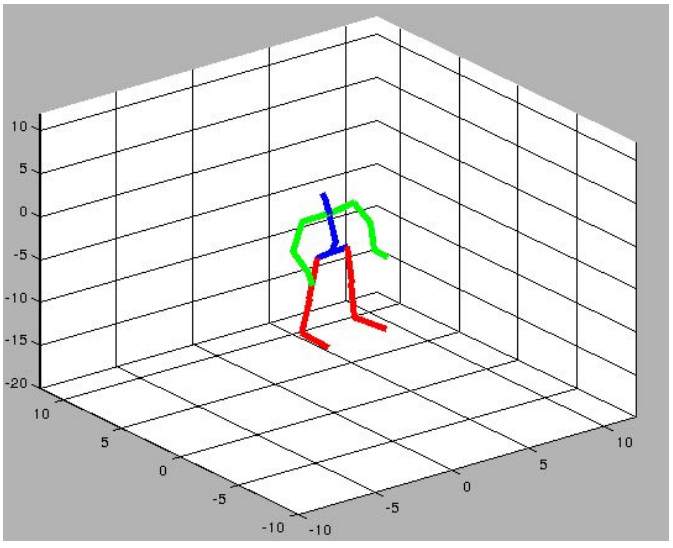
Go to “Import .CSV” and select an intended CSV file. YOu will be asked if the directory, where the current selected file is located. will be saved as default. So you do not have to browse through different directories while searching for a file.

File name will be displayed in the top right of the tool.

III. Play forwards or backwards the sequence using the buttons on the left-bottom of the tool. There are two modes for displaying the measurements: normalized and non-normalized. The normalized mode display the measurements relative to a certain and fixed human segment, for example the lower back. So, the center will be always located at that position. IN the non-normalized case, the measurements are relative to the Hall.



This image shows an example of how the normalize mode displays the measurements.



If the skeleton is not displayed, click on the 3D plot. The 3D plot and the two sliding boxes on the top-right must be initialized by clicking on them.

IV. sdsdsd
V. dsdsd

Documentation of Annotation

- The .xlsm File contains a list of all 35 recordings to be annotated by each annotator.
- In order to achieve an uninfluenced and scientifically correct protocol of the annotation effort, please use the annotating tools as follows:
- Please fill in Documentation_annotating_person.xlsx before you start annotating your first sequence.
- Save your file and send it to me: michelle.schlangen@tu-dortmund.de
- Please do not show your filled out file to any other annotator.
- Then use Documentation_Annotation.xlsm file to record your annotation. Fill in all necessary information and save it on your computer. Detailed instructions are given in the document itself.
- Again, please do not show your annotating record to other annotators.
- Once you filled in the whole document, please send it to me: michelle.schlangen@tu-dortmund.de

- If any questions occur, you can contact me via e-mail: michelle.schlangen@tu-dortmund.de