

# 1 Introduction

The following document offers some details on the gesture dataset. It contains a detailed presentation of the annotation process(sec. 2) as well a visual description of the different gestures found in the dataset sec. 3.

## 2 Database annotation

This section details the annotation process of the database, 2.1 goes over the labelling process, while 2.2 discussed the model of joints tracked using the motion capture system.

### 2.1 Gesture labeling convention

Inside the QTM files, the gestures are segmented using a couple of QTM events indicating the beginning and the end of the gesture. The couple will follow the naming convention:

(*gesture-[1 – 9][KFGSL][PFN][RLB][CN]-[0000 – 9999],gesture\_end*)

An explanation of this convention is presented in tab 1.

Key	Description
gesture	The gesture name in English, the spaces are ignored.
[1 – 9]	A numeral identifier on the gesture, should be a numeral {1: static, 2 and above: number of oscillations}
[KFSGL]	A letter describing the position of the subject while doing the gesture, should be one of five {K: kneeling, F: Floating, S: standing, G: leg is blocked, L: lying while connected to the wall}
[PFN]	A letter describing the rest position of the subject while doing the gesture, should be one of three {P: parallel to the body, F: Floating, N: no rest between the gestures}
[RLB]	A letter describing the hand used to perform the gesture, should be one of three {R: right, L: left, B: both}
[CN]	A letter describing if the gesture is conforming or not, should be one of two {C: conforming, N: non-conforming}
[0000 – 9999]	A counter value on each gesture to have a unique identifier.

Table 1: Naming convention of the gesture labeling process.

For example, the couple (*goup\_3KFRG\_0023,goup\_end*) indicates a *go up* gesture, performed three times with the right arm, during the resting phase the hands are floating hands, the gesture is considered a conforming gesture, more example can be seen in 1. This is the first file on the database, concerning the counter value used for each gesture. It will be reset to the ceiling of the tenth digit at the beginning of every sequence. For example, the sequence seen in 1 stops at 14. The gesture counter will start at 20 in the following QTM file, as a precaution. Thus, if by human error a gesture was unlabeled or not counted properly, it allows a window of correction.

Event	Time	Frame	Color
notwell_5KPRC_0001	10.392	1248	
notwell_end	17.442	2094	
assemble_1PKBC_0002	18.042	2166	
assemble_end	22.833	2741	
stabilize_3KPBC_0003	29.458	3536	
stabilize_end	35.975	4318	
come_3KPRC_0004	40.475	4858	
come_end	46.100	5533	
panting_3KPBC_0005	52.658	6320	
panting_end	60.000	7201	
stabilize_3KPBC_0006	65.942	7914	
stabilize_end	72.017	8643	
assemble_2KPBC_0007	77.433	9293	
assemble_end	82.433	9893	
panting_3KPBC_0008	88.950	10675	
panting_end	96.092	11532	
stabilize_3KPRC_0009	101.342	12162	
stabilize_end	108.050	12967	
come_2KPRC_0010	112.733	13529	
come_end	117.492	14100	
stabilize_3KPBC_0011	124.992	15000	
stabilize_end	133.367	16005	
panting_3KPBC_0012	136.733	16409	
panting_end	144.608	17354	
goup_1KPRC_0013	149.467	17937	
goup_end	153.650	18439	
godown_1KPRC_0014	160.883	19307	
godown_end	163.375	19606	

Figure 1: A list of labeled gestures as seen in Qualisys Track manager.

## 2.2 AIM models

The QTM software has a function that identifies and labels trajectories for a particular marker set using Automatic Identification of Markers (AIM). Fig. 2 showcases the AIM model employed for the March campaign, for previous campaigns similar AIM was used without the knees and foot components. The labels used are the following:

Right side (in red):

- front\_right
- shoulder\_right
- elbow\_right
- pelvis\_right
- wrist\_right\_in (the proximal side)
- wrist\_right\_out (distal side)
- knee\_right
- foot\_right
- wrist\_right

Left side (in green):

- front\_left
- shoulder\_left
- elbow\_left
- wrist\_left\_out
- pelvis\_left
- knee\_left
- foot\_left
- wrist\_left

For both sides, the *wrist\_side* tracks a virtual point that is the average of *wrist\_side\_in* and *wrist\_side\_out*. We also note that the *wrist\_side\_in* is colored with a darker shade of the same color as seen in Fig. 2b.

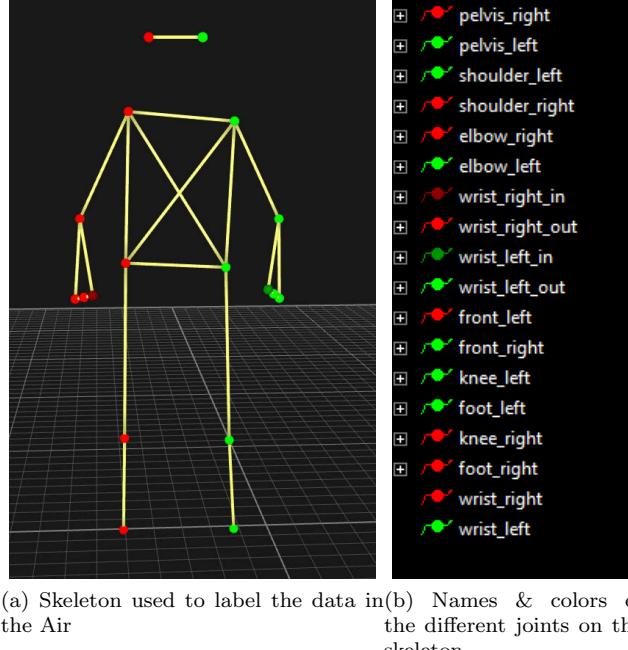


Figure 2: AIM model used

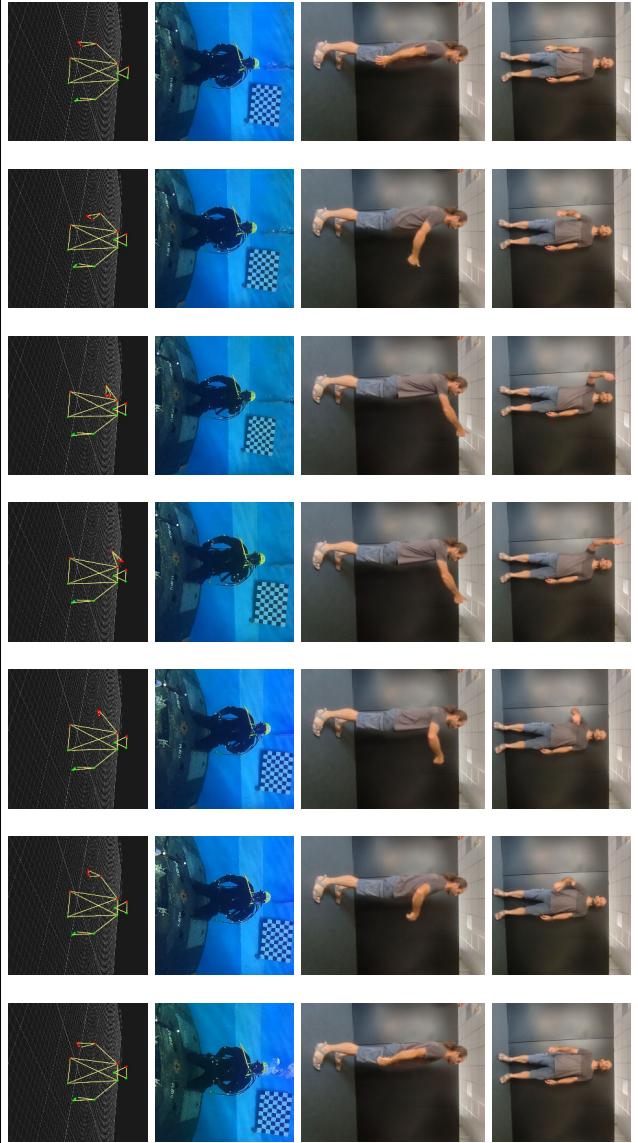
### 3 Gesture Description

The dataset contains 14 different gestures presented in the following table: A more visual gesture

Gesture (in French)	Static/ oscilla- tory	one/two hands	Standard/ Non-Standard	Table
Go up	static	one arm	standard	Tab. 3
Go down	static	one arm	standard	Tab. 5
Ok (ok)	static	one arm	standard	Tab. 7
Reserve	static	one arm	standard	Tab. 8
Half-pressure	static	two arms	standard	Tab. 9
Assemble	static	two arms	standard	Tab. 10
End of dive / exercise	static	two arms	standard	Tab. 11
Not well	oscillatory	one arm	standard	Tab. 12
Panting	oscillatory	two arms	standard	Tab. 13
Cold	oscillatory	two arms	standard	Tab. 14
Stabilize	oscillatory	two arms	standard	Tab. 15
Out of air	oscillatory	two arms	standard	Tab. 16
Stop (stop)	-	-	non-standard	Tab. 17
Come (viens)	-	-	non-standard	Tab. 18

Table 2: Summary table of all gestures

description can be found in the tables (3- 18). To be noted, in the case of the gesture *stop* and *come* are not standardized conventional gestures. The kinogram presented for these gestures serves only as an example of a possible performance of these gestures.



Starting pose	Ascending phase	Descending phase	End pose		
Upright standing position, arms on the side, hands open. Head in line with the spine, looking towards the sign recipient.	1/3 Up-right standing position. Ascending movement of the arm on the sagittal plane, the elbow is slightly bent, at the same level as the shoulder, and the hand is forming a fist except for the thumb which is pointing upward. The wrist is pronated/supinated or neutral position.	2/3 The hand maintains the same pose. The elbow is slightly bent, at the same level as the shoulder, and the hand is at the same level as the head. This position is maintained for a few seconds.	3/3 + static pose The hand maintains the same pose, the elbow is as well. The arm is moving downward on the sagittal plane. The hand is at the same level as the head. The wrist is bent; this position is maintained for a few seconds.	1/2 The hand gesture is stopped, and the wrist is in pronation. The arm is moving downward on the sagittal plane going back to the rest position. The subject is back to rest position.	1/2 The wrist is in pronation. The arm is moving downward on the sagittal plane going back to the rest position. The subject is back to rest position.

**Accepted Variation:** The Ascending phase is repeated more than once, up to five times

as seen in Tab. 4.

**Non-Accepted Variation:** The gesture is performed using the two hands. Applies to both variations.

Table 3: The standard gesture "go up" decomposed into different phases.

Starting pose	Oscillating phase			
	1/3	2/3	3/3	1/3
Upright standing/kneeling, arms on the side, hands are open. Head in line with the sign recipient.	Ascending movement of the arm on the sagittal plane, the elbow is slightly bent. The hand is forming a fist, except the thumb which is pointing upward. The wrist is pronated/supinated or neutral position.	The hand maintains the same pose. The elbow is slightly bent, at the same level as the chest. The hand is at the same level as the head.	The hand maintains the same pose. The elbow is slightly bent, at the level of the shoulder. The hand is slightly above the head.	The hand maintains the same pose, the elbow goes down, it is below the chest level, before engaging in a new ascending movement on the sagittal plane.
				
Oscillating phase	Descending Pose	End Pose		
2/3	3/3	1/2	2/2	
Ascending movement of the arm on the sagittal plane, the elbow is slightly bent. The hand maintains the same pose. The same level as the head. The wrist is pronated/supinated or neutral position. The elbow is slightly bent, at the same level as the shoulder. The hand is at the same level as the head.	The hand maintains the same pose. The elbow is slightly bent, at the same level as the chest. The hand is at the same level as the head.	The hand gesture is stopped, and the wrist is in pronation. The arm is moving downward on the sagittal plane going back to the rest position.	The wrist is in pronation. The arm is moving downward on the sagittal plane going back to the rest position.	The subject is back to rest position.
				

Table 4: The oscillating variation of the "go up" gesture with 2 oscillatory phases.

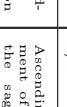
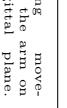
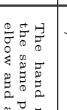
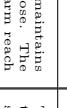
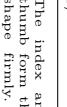
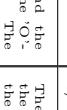
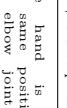
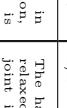
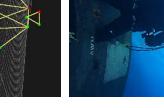
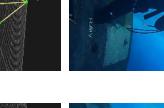
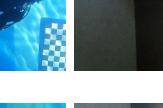
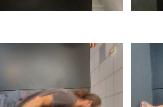
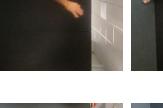
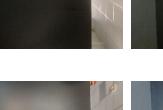
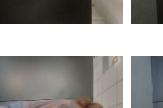
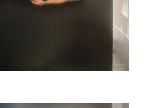
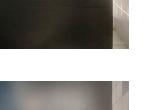
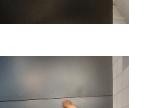
Starting pose	1/4	2/4	3/4	4/4	1/2+static phase	2/2	Descending phase	End pose
Upright standing, kneeling, arms on the side, hands are open, hand is pointing toward the sign receiver.	Ascending movement of the arm on the same pose. The sagittal plane, elbow and arm stop rising at the level of the heart. The hand is forming a "fist", except the thumb which is moving upward. The wrist is supinated and the thumb is moving downward.	Ascenting movement of the arm on the same pose. The sagittal plane, elbow and arm stop rising at the level of the heart. The hand is forming a "fist", except the thumb which is moving upward. The wrist is supinated and the thumb is moving downward.	The hand maintains the same position, and the elbow is at the level of the chest. The arm is moving downward on the lever of the chest. The hand is pointing toward the sign receiver.	The hand remains in the same position, and the elbow is at the level of the chest. The arm is moving downward on the lever of the chest. The hand is pointing toward the sign receiver.	The hand maintains the same position, and the elbow is at the level of the chest. The arm is moving downward on the lever of the chest. The hand is pointing toward the sign receiver.	The hand maintains the same position, and the elbow is at the level of the chest. The arm is moving downward on the lever of the chest. The hand is pointing toward the sign receiver.	The hand remains in the same position, and the elbow is at the level of the chest. The arm is moving downward on the lever of the chest. The hand is pointing toward the sign receiver.	The subject is back to rest position.

**Accepted Variation:** The descending phase is repeated more than once, up to five times as seen in Fig. 6  
**Non-Accepted Variation:** The gesture is performed using the two hands. Applies to both the conventional and non-conventional variations.

Table 5: The standard gesture “go down” decomposed into different phases.

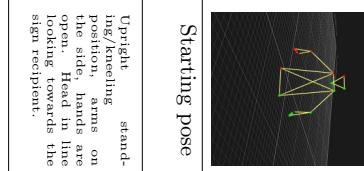
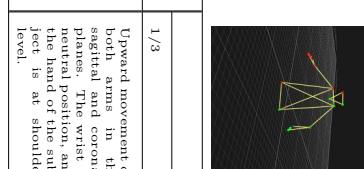
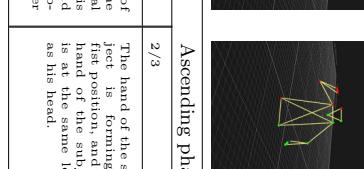
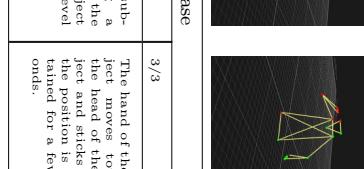
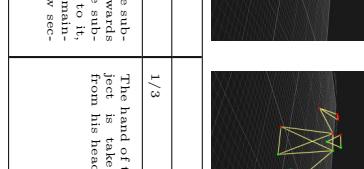
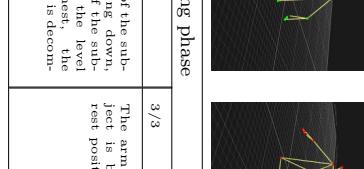
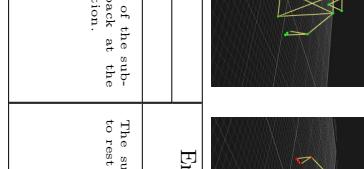
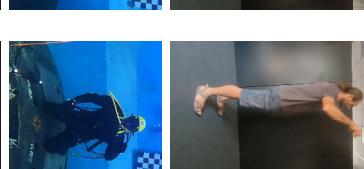
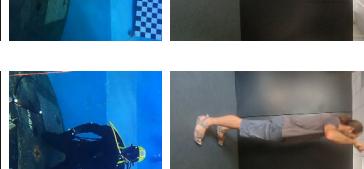
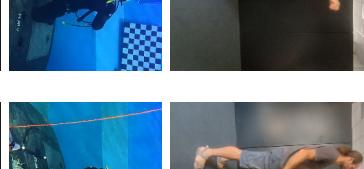
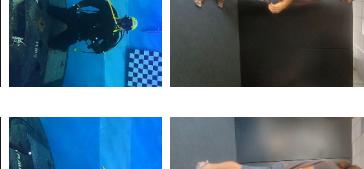
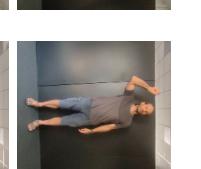
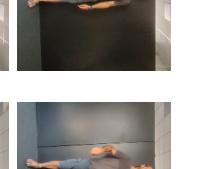
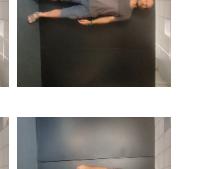
Starting pose	Ascending phase				Oscillating phase		
	1/2	2/2	1/3	2/3	3/3		
Upright standing/Kneeling position, arms on the side, hands are open. Head in line looking towards the sign recipient.	Ascending movement of the arm on the sagittal plane, the elbow is slightly bent. The hand is forming a fist, except the thumb which is pointing upward. The wrist is pronated/supinated or neutral position.	The hand maintains the same pose. The elbow and arm stop rising at the level of the head. The arm is rotating around itself, the wrist is moving to a supinated position, and the thumb is moving downward to point downward.	The hand remains in the same position. The elbow and arm stop rising at the level of the arm. The arm starts moving downward.	The hand remains in the same position, and the elbow is at the level of the chest. The hand is still pointing downward.	The hand is in the same position. The elbow is maintained at the level of the chest. The arm is moving downward.	The hand is in the same position. The elbow is maintained at the level of the chest, the hand is below the chest.	
Oscillating phase		Descending phase		Descending phase		End pose	
1/3	2/3	3/3	1/2	2/2			
The hand maintains the same pose. The forearm is moving upward, the hand is at the same level as the elbow and the chest. The wrist is supinated, and the thumb is still pointing downward.	The hand remains in the same position. The elbow is at the same level as the arm. The arm starts moving downward.	The hand remains in the same position, and the elbow is at the level of the arm. The arm starts moving downward.	The hand maintains the same position. The arm is moving downward on the sagittal plane, the elbow is slightly bent.	The hand sign is stopped, and the arm is going down to reach the resting position.	The subject is back to rest position.		

Table 6: Oscillating variation of the "go down" gesture with 2 oscillating phases.

Starting pose	1 / 4	2 / 4	3 / 4	4 / 4 + static Phase	1 / 2	2 / 2	End pose
Upright standing/kneeling position, arms on the side, hands are open. Head in line looking towards the sign recipient.	A ascending movement of the arm on the sagittal plane. The index and thumb start forming an 'O' shape. This is neutral/supinated. The elbow joint is extending.	The hand maintains the same pose. The elbow and arm reach the level of the subject chest. The wrist is neutral/supinated, this forms a perpendicular angle.	The index and the thumb form the 'O' shape firmly. The three remaining fingers are extended, and the hand moves forward on the sagittal plane. This position is maintained for a few seconds.	The hand is in the same position, the elbow joint is flexed, and the arm and forearm are extended, and the hand moves forward to the rest position.	The forearm is back to the rest position, the elbow joint is extended, and the hand is moving back to the rest position.	The subject is back to rest position.	
							
							
							
							
							
							
							
							

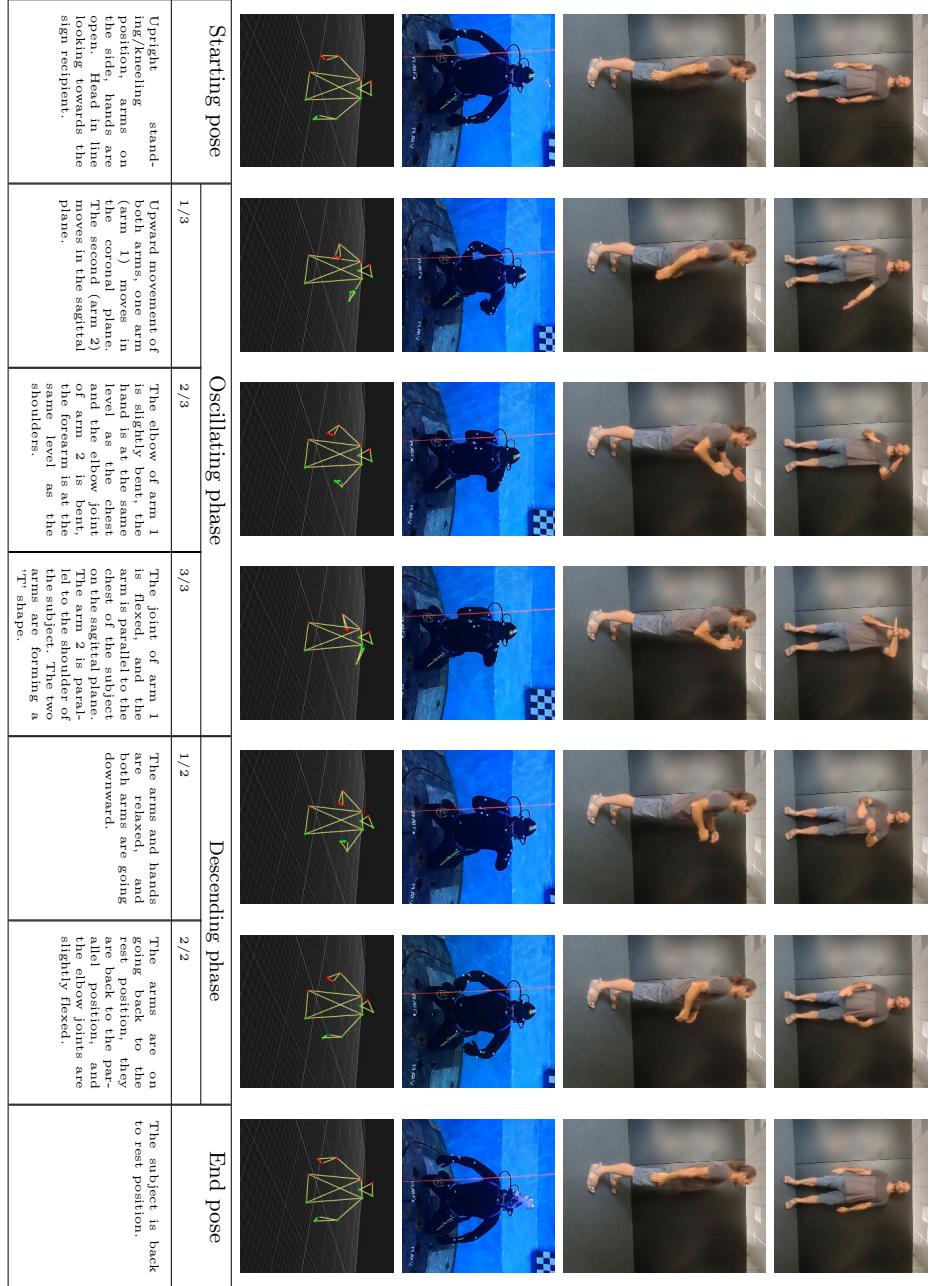
**Accepted Variation:** Step 3 and 4 of the ascending phase are repeated up to 3 times.

Table 7: The standard gesture "ok" decomposed into different phases.

Starting pose	Ascending phase						End pose
	1/3	2/3	3/3	1/3	2/3	3/3	
Upright standing/kneeling position, arms on the side, hands are open. Head in line with the hand of the subject looking towards the sign recipient. Subject is at shoulder level.	Upward movement of both arms in the sagittal and coronal planes. The wrist is in a neutral position, and the hand of the subject is at the same level as his head.	The hand of the subject is forming a fist position, and the head of the subject sticks to it. The position is maintained for a few seconds.	The hand of the subject moves towards the head of the subject and sticks to it. The position is maintained for a few seconds.	The hand of the subject is taken away from his head.	The hand of the subject is going down, the hand of the subject is at the level of the chest, the fist gesture is decomposed.	The arm of the subject is back at the rest position.	The subject is back to rest position.
							
							
							

**Non-Accepted Variation:** The gesture is performed with repetition, the hand of the diver moves towards and away from his head more than once.

Table 8: The standard gesture “reserve” decomposed into different phases.



**Accepted Variation:** Different angle between the two arms.

Table 9: The standard gesture "half-pressure", decomposed into different phases.

Starting pose	Ascending phase	Descending Phase	End pose
1/3 Upright standing/kneeling position, arms on the side, hands are open. Head in line looking towards the sign recipient.	2/3 Upward movement of both arms in sagittal and coronal planes. The wrists are in neutral positions, the hand is forming a fist except the index pointing outward.	3/3 + static pose Both hands and elbows are at the same level as the chest. The elbow joints are fully flexed.	1/2 The gesture of the hand is decomposed, front of the head and the forearm are starting to go down. The elbow joint is fully extended. The movement is limited to the transverse plane. This position is maintained for a few seconds.

**Accepted Variation:** The gesture is performed with open hands instead of a fist with pointing out fingers.

**Non-Accepted Variation:** Multiple repetitions of the steps 2 till 4 of ascending phase. The gesture would be classified as 'stabilize'.

Table 10: The standard gesture "assemble" decomposed into different phases.

Starting pose	Ascending phase	Descending phase	End pose
Upright standing/kneeling position, arms on the side, hands are open. Head in line with the body, looking towards the sign recipient.	1/2 Ascending movement of both arms on the sagittal plane, the elbow is slightly bent, and the elbow joint is slightly flexed. The fingers are fully extended. The wrist is in a neutral position.	2/2 Both arms are in front of the chest forming an 'X' shape, and the hands are in the same position as in the starting pose. The hand maintains the same pose, the 'X' gesture is decomposed, and the subject is taking his hands down.	1/1 The subject is back to rest position.

Table 11: The standard gesture "end of dive / end of exercise" decomposed into different phases.

Starting pose	Oscillating phase				Descending phase	End pose
	Ascending phase	1/4	2/4	3/4	4/4	1/1
Upright standing/kneeling position, arms on the side. Hands are open. Head in line with the sign recipient.	Ascending movement of the arm on the sagittal plane. All the fingers are extended, and this wrist is neutral.	The hand remains in the same position, and arm reach the chest level. The elbow joint is fully extended. The wrist is supinated.	The hand, elbow, and arm remain in the same position. The elbow joint is fully extended. The wrist is pronated.	The hand, elbow, and arm remain in the same position. The elbow joint is fully extended. The wrist is supinated.	The hand, elbow, and arm remain in the same position. The elbow joint is flexed, and the arm and forearm start to go down.	The subject is back to rest position.

**Accepted Variation:** Multiple repetitions of the oscillation phase. The subject starts with pronation instead of neutral.

Table 12: The standard gesture "not well" decomposed into different phases.

Starting pose	Ascending phase	Oscillating phase	Descending phase	End pose
Upright standing, kneeling position, arms on the side, hands are open, hand is pointing toward the sign recipient.	1 Ascending movement of both arms on the same pose. The elbow joints are both fixed, the elbows are bent, the torso is extended, the arms are at the same level as the shoulders, and the wrists are neutral.	1/3 The hand maintains the same pose. The elbow joints are both fixed, the elbows are bent, the torso is extended, the arms are at the same level as the shoulders, and the wrists are neutral.	2/3 The hand maintains the same pose. The elbow joints are both fixed, the elbows are bent, the torso is extended, the arms are at the same level as the shoulders, and the wrists are neutral.	3/3 The hand maintains the same pose. The elbow joints are both fixed, the elbows are bent, the torso is extended, the arms are at the same level as the shoulders, and the wrists are neutral.

**Accepted Variation:** Multiple repetitions of the oscillation phase up to 5 times.

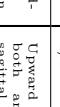
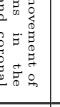
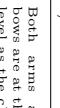
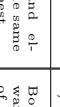
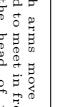
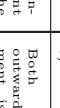
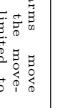
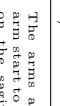
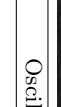
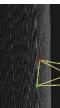
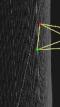
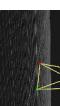
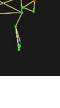
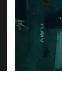
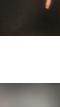
**Non-Accepted Variation:** Only one repetition of the oscillation phase.

Table 13: The standard gesture “painting” decomposed into different phases.

Starting pose	Oscillating phase					Descending Phase	End pose
	1/5	2/5	3/5	4/5	5/5		
Upright standing/kneeling position, arms on the side, hands are open. Head in line looking towards the sign recipient.	The elbow joint is flexed. The hand of arm 2 moves closer to the chest of the subject, while arm 1 moves away from the chest of the subject.	The elbow joint is extended. The hand of arm 2 moves closer to the chest of the subject, while arm 1 moves away from the chest of the subject.	The elbow joint is flexed. The hand of arm 2 moves closer to the chest of the subject, while arm 1 moves away from the chest of the subject.	The elbow joint is extended. The hand of arm 2 moves closer to the chest of the subject, while arm 1 moves away from the chest of the subject.	The elbow joint is flexed. The hand of arm 2 moves closer to the chest of the subject, while arm 1 moves away from the chest of the subject.		

**Accepted Variation:** multiple repetitions of the oscillation phase up to 5 times.

Table 14: The standard gesture “cold” decomposed into different phases.

Starting pose	Oscillating phase					Descending phase	End pose
Ascending phase	1/1	1/4	2/4	3/4	4/4	1/1	
Upright standing, arms on the sides, hands open. Head in line with the body. Eyes looking towards the sign recipient.	Upward movement of both arms in the sagittal and coronal planes. The wrists are in neutral position, all fingers are flexed.	Both arms and elbows are at the same level as the chest.	Both arms move inward to meet in front of the head of the subject, and the elbow joint is fully extended. The movement is limited to the transverse plane.	Both arms move outward, the movement is limited to the transverse plane.	The arms and forearms start to go down on the sagittal and coronal planes, the hands are relaxed, and the elbow joints are slightly flexed.	The arms and forearms continue to go down on the sagittal and coronal planes, the hands are relaxed, and the elbow joints are extended.	The subject is back to rest position.
							
							
							
							
							
							
							
							
							
							
							

**Accepted Variation:** multiple repetitions of the oscillation phase up to 5 times

**Non-Accepted Variation:** Only one repetition of the oscillation phase. It would be classified as 'assemble'.  
**Non-Accepted Variation:** Gesture performed with only one arm.

**Noh-Accepted Variation:** Gesture performed with only one arm.

Table 15: The standard gesture "stabilize" decomposed into different phases.

Starting pose	Oscillating phase					Descending Phase	End pose
	1/1	1/4	2/4	3/4	4/4		
Upright standing/Kneeling position, arms on the side, hands are open. Head in line looking towards the sign recipient.	Upward movement of the arm, the joint of the elbow if fully extended the arm of the subject reaches the same level as the chest.	The elbow joint is flexed, the hand moves closer to the neck of the subject.	The elbow joint is extended, the hand moves away from the neck of the subject.	The elbow joint is extended, the hand moves away from the neck of the subject.	The elbow joint is downward movement of the arm in the coronal plane. All fingers are opened, the wrists are neutral.	The subject is back to rest position. All fingers are opened, the wrists are neutral.	

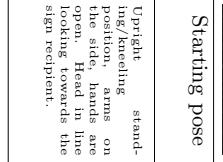
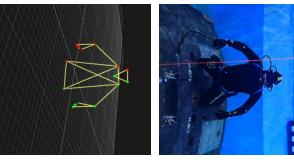
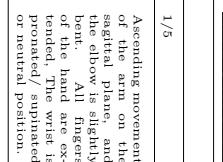
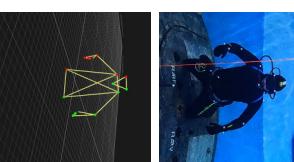
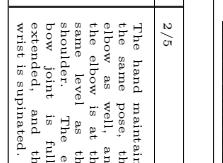
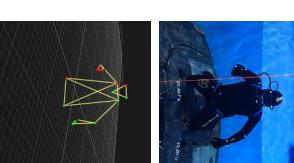
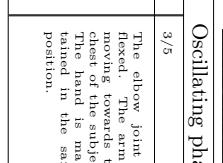
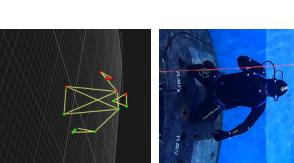
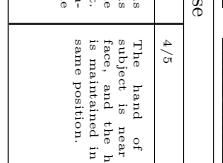
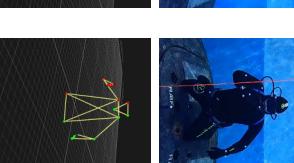
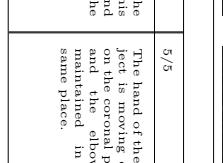
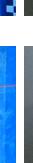
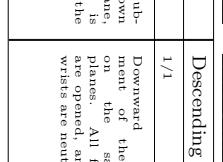
**Accepted Variation:** multiple repetitions of the oscillation phase up to 5 times.

Table 16: The standard gesture "out of air" decomposed into different phases.

Starting pose	Ascending phase				Descending phase		End pose
	1/3	2/3	3/3 + static phase	1/2	2/2		
Upright standing position; arms on the side, hands are open. Head in line looking towards the sign recipient.	Ascending movement of the arm on the sagittal plane. All fingers are open, this wrist is neutral.	The hand maintains the same pose. The elbow and arm stop rising at the level of the subject chest. The hand of the subject is at the same level as the head. This position is maintained for a few seconds.	The arm-to-forearm is fully extended in the sagittal plane. The hand of the subject is relaxed and going down, the elbow joint has flexed the hand of the subject. This position is going backward.	The hand sign is stopped. The hand is relaxed and going down, the elbow joint has flexed the hand of the subject. This position is going backward.	The forearm is at the same level as the chest on the coronal plane, the arm is going back to the rest position, elbow joint is extended.	The subject is back to rest position.	

**Variation:** Given that *stop* is a non-standard gesture, any other performance of the gesture is accepted as long as it can be interpreted as *stop*.

Table 17: The gesture "stop" decomposed into different phases.

Starting pose	Oscillating phase					Descending phase	End pose
	1/5	2/5	3/5	4/5	5/5		
Upright standing/preceding position, arms on the sides, hands are open. Head in line looking towards the sign recipient.							
							
							
							
							
							
							

**Variation:** Given that *come* is a non-standard gesture, any other performance of the gesture is accepted as long as it can be interpreted as *come*.

Table 18: The gesture “comes” decomposed into different phases.