DELIVERABLE REPORT

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WP 7, Task 7.2 Set of functional ADL movements

1 DESCRIPTION OF THE TASK

Comparison tests between standard tests (SHAP, SHELF-Test) and complex ADL test. The aim is to find a set of functional ADL movements which will be most identified and to be suggested for all further practical tests.

2 DESCRIPTION OF DELIVERABLE

Well expected tests like the SHAP describes the overall function of the patient with the prosthesis. A shorter execution time will describe a better functional use of the prosthetic limb. However, these tests do not describe in more detail how any time differences were accomplished. Compensatory movements which may have an adverse ling term influence on the patient are not considered. The main goal of this work task will be to compare the outcome of the traditional tests to the performance in functional ADL movements, captured by a motion capture system. The correlation between the different tests and how any compensatory movements can be quantified will be elaborated.

3 IMPLEMENTATION OF WORK

In myoelectric controlled prostheses the transmission from laboratory to daily use has been challenging. Both results from laboratory based tests and offline tests don't always agree with daily use experiences. Therefore, Vujaklija et al. recommend testing a myoelectric control system using appropriate clinical tests. They mention several clinical tests (Box and Blocks – Test [1], SHAP-Test [2]) and highlighted the fact that those existing clinical tests are still limited in fully representing functional benefits of prosthetic systems for patients [3]. Due to this knowledge we started developing a set of functional ADL movements.

Before we started developing a set of functional ADL movements we have met with the other clinical partners of UMCG and we have discussed which ADL movements should be preferred and which are

the most identifying for the test functionality of prosthetic use. In collaboration with UMCG a questionnaire for a interview study was worked out to find most relevant ADLs for prosthesis users with and without experience of pattern recognition (PatRec). Meanwhile we started performing some tests with normative subjects (SHAP-Test, SHELF-Test) to receive normative data and to test the feasibility and the duration of measurements.

In collaboration with UMCG and according to the interviews we would like to work out specific ADL movements. In pre-tests we will test if the performance is possible with normative subjects using able-bodied adapters and prosthesis users. In the next sections chosen ADL movements for the test protocol are described in detail. All movements are additionally captured via 3D motion capture system to receive data of movement patterns of subjects. Therefore spherical retro-reflective markers are applied on the upper body of participants according to the upper limb model of van Andel et al. [4]. Then the joint angles during all tasks are calculated using the open source procedure ULEMA [5], [6]. All tasks are repeated three times to get consistent results. The number of failures during a task and the execution time of the whole movement, as well as the time defined sub phases are also noted. Furthermore, we will use the Disabilities of the Arm, Shoulder and Head (DASH) questionnaire [7] to provide data of symptoms and functional status focusing on physical function. A self developed questionnaire (see appendix) is additionally used to receive subjective data for the handling and for the robustness of control of the prostheses.

The aim of this work is to define a testing protocol which suggests a standardized evaluation procedure for researchers or clinical partners and those who consider evaluating trans radial prosthetic designs.

3.1 INTERVIEW STUDY TO FIND ADL:

To define specific ADL movements for trans-radial amputees the UMCG investigated an interview. Therefore UMCG worked out a questionnaire and we started working on ethical approval. Recruiting took place at OBH and they fixed appointments at the OSS for the interview study. Meanwhile a colleague of UMCG had started the interview study in the Netherlands. Receiving consistent interview results we also decided that the colleague of UMCG should also do the interview part at the OSS. To gain a deeper insight the OSS was also present during the interviews: At the OSS four users with experience in pattern recognition were interviewed. The interview part of UMCG included 23 subjects (12 patients with conventional control and four patients with pattern recognition) in two rehabilitation centres (UMCG Groningen and De Hoogstraat Utrecht Revalidatie). 7 therapists who have experiences with prosthesis users for minimum 6 months were also recruited for this study (6 therapists experienced with conventional design, 1 therapist experienced with PatRec. design). To analyse the interview part a five step framework was approached (Familiarization, Creating a thematic framework, Indexing, Charting and Mapping & Interpretation, [8]) based on the software AtlasTI 7.5.17. In consultation with UMCG and according to the interview results, the most relevant ADLs were determined for further analysis (see section 3.5).

3.2 SHAP TEST

In literature the SHAP-Test is often mentioned to evaluate functionality of prosthetic design. Therefore we also suggest this test to receive full information of prosthetic use additional to the ADL movements in section 3.5. The test includes 12 gross motor function tasks and 14 ADLs which are performed with the prosthetic side. A shorter execution time leads to a better total Score of the SHAP-Test (Index of Function Score –IOF). However, these tests do not describe in more detail how time differences were accomplished. Compensatory movements which may have an adverse ling term influence on the patient are not considered. While subjects are performing the SHAP test, the

trajectories of markers and the resulting joint angles are calculated. The arm movement analysis map (A-Map) is established to simplify interpretation of kinematic data and to detect compensatory movements concerning joint angles [6]. The A-Map contains the root mean square differences for each patient's angle relative to the normative subjects. The Arm Profile Score (APS) is described as the root mean square average of the root mean square differences of the A-Map. In literature the APS was already established as a new summery index to evaluate the level of upper limb movement pathology based on kinematic data [6]. Hence, the idea of this part is to capture the SHAP-test via a 3D motion capture system in order to additionally detect compensatory movements and to calculate the correlation between the IOF and the APS.

3.3 SHELF-TEST

This test was worked out in the thesis of Amsuess [9] and it allows fully controlling 3.5 degrees of freedom of the prosthetic. Hence, we suggest including the SHELF-test in the testing protocol, because the results of it may provide a good overview to control and manipulate prostheses with 3.5 degrees of freedom. Subject grasps an object at shoulder level (80 % of body height, flexion and open and close hand are needed) and put it to a shelf at 55% of body height. The distance between subject und shelf's is 66 % of the distance between acromion and ulnar styloid processus of the investigated arm in 90° flexed position. While moving the object the subject has to rotate it 90° and lowers it back to the lower shelf. Then the subject rotates it again 90° and put it down (Figure 1). For more efficient analysis the task is separated into three sub phases (as describe in Figure 2: control & grasp, manipulate & lower and grasp, manipulate & lower). The execution time of the task will also be noted and five valid trials are used for analysing. This test is planned to capture 20 normative subjects and 5- 10 amputees in order to compare the movement patterns.

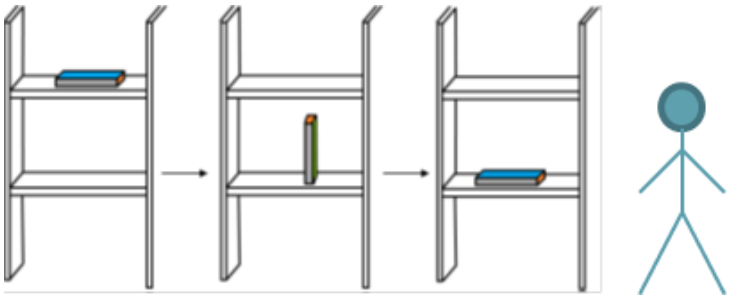

Figure 1: Schematic description of the SHELF-Test. Subject moves and rotates (90°) an object from a shelf at shoulder level (80% of body height) to a shelf at 55% of body height. Then he/ she rotatoes the object again (90°) and lowers it back.

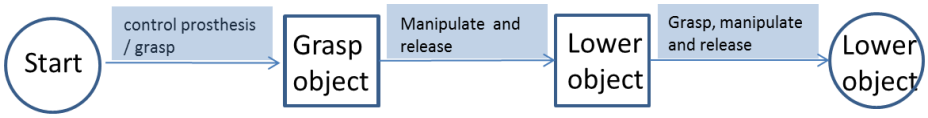

Figure 2: Separation into sub phases for the SHELF-Test performance

3.4 DUAL TASK SITUATION

Because of absence of sensory feedback, the users need visual attention to the prosthetic device while performing a task. Visual attention may affect the performance of ADLs. Dual tasks, where amputees perform a specific task without full concentration on it, are also most relevant in daily routine. Therefore, this section contains different ADLs, which are most representative for daily living and which are feasible as much as possible within a laboratory.

In the developed dual task situation, subjects stand in front of the working area with arms hanging besides the body. Then subjects perform the SHELF-Test (as described in section 3.3 and Figure 1: Schematic description of the SHELF-Test. Subject moves and rotates (90°) an object from a shelf at shoulder level (80% of body height) to a shelf at 55% of body height. Then he/ she rotatoes the object again (90°) and lowers it back.). Additionally, the subjects have to perform a reaction part. Therefore, two push buttons are additionally implemented in the working area on the left and on the right side. If subjects perform the usability part (SHELF-Test) with the right hand, they have to push the buttons with the left hand and the other way around. While subjects are performing the usability part, they also have to focus on the reaction part. If a button flashes they have to push it as quick as possible. The time until the subject pushes the buttons and the total time of the SHELF-Test are noted.

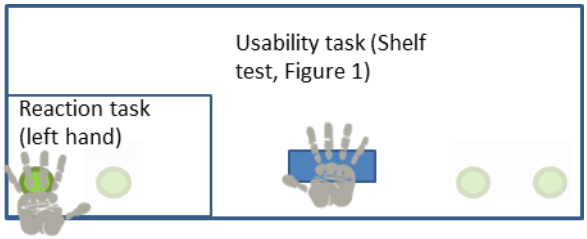

Figure 3: Schematic description of dual task situation performing with right hand and the reaction part with left hand: They perform the SHELF-Test (see Figure 1) and also have to perform simultaneously the reaction part. Therefore push buttons are implemented in the working area on both sides. If subjects perform the usability part with the right hand, they push the button with the left hand and the other way around. While subjects are performing the usability part, they also focus on the reaction part. As soon as a button flashes they are supposed to push it as quick as possible.

3.5 MOVEMENTS OF DAILY LIVING

During the interview study the tasks related to mobility, to food preparation (eating & drinking) and to dressing were mentioned quite frequently. While tests about biking or driving a car might be harder to integrate within a laboratory, tasks about food preparation and/or dressing should be easily implemented. Those tasks, requiring two hands, are the most relevant activities of daily living for prosthesis users, since basically all of such activities were repeatedly mentioned during the interviews (opening/closing a jar/bottle, cutting/ peeling fruits/vegetables. In Figure 4 to Figure 8 all tasks are separated in sub phases in order to do a precise evaluation in each phase. For the patient tests we recommend to include the DASH questionnaire[1] and the self developed questionnaire to provide subjective data for the handling, the control and the robustness of prostheses.

1. Moving a tray (bilateral) and grasping objects (unilateral)

The idea for this task is to combine bilateral task (lifting tray) with unilateral grasping tasks. Therefore the participants lift the tray from a specific position (80% of body height), walk around and lower it back to a position of 60% of body height. Then subjects grasp several objects (objects of SHAP-Test like tripod, cup and additional object like a plate) which force them to use different types of grips, rotation and flexion/ extension and they have to put it down to a specific position which is marked and predefined on the tray. The full tray is picked up and the subjects walk again and they place the tray at a working area (height: 90cm). This task is repeated three times. It is expected that it is a good task to evaluate if pattern recognition control allows holding movements for a longer period of time or if it causes involuntary movements. Additionally, the unilateral tasks show how to move and manipulate objects using both algorithms.

[1] http://www.dash.iwh.on.ca/about-dash

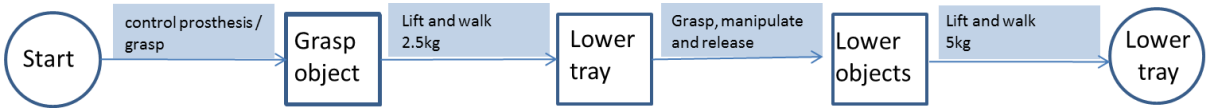

Figure 4: Sub phases of lifting a tray and grasping and manipulating objects

2. Holding and transferring a bag

The subjects hold a bag with the prosthesis hand. The bag holding arm hangs beside the body and they walk 10 m. After walking the subjects fill several objects in the bag with the sound hand. Afterwards the subjects walk again 10 m with the filled bag (hanging beside the body) and release it at the end position. Alternatively, it is possible to use a plate or a basket instead of the bag or to vary the weights. This task simulates daily situations in which weight bears the socket.

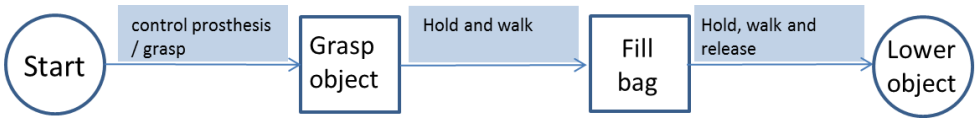

Figure 5: Sub phases of carry a bag task

3. Eating simulation (bilateral)

Subjects use their affected side for holding a simulated food object with a fork. With the sound side they cut the food. A more complex variation of this task is to repeat this procedure and to get more pieces of food. The material of the food could be a plastic modelling mass.

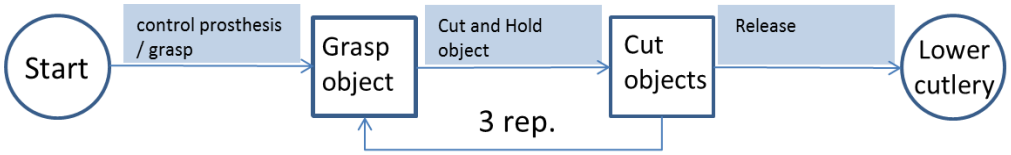

Figure 6: Sub phases of eating task

4. Opening/ closing a jar (bilateral)

This ADL copies the task of the SHAP-Test. Subjects grasp a jar from a shelf (80% of body height) with the affected side and they open it with the sound side. Afterwards they put the jar to a lower marked level on the shelf. To make the task more complex the subjects grasp the jar again and close it and put it back to the starting position.

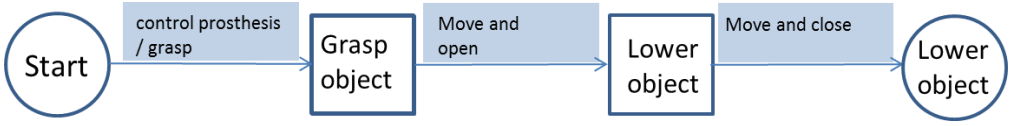

Figure 7: Sub phases of opening a jar and closing a jar

5. Dressing task

Subjects stand in the middle of the capture volume and they open a zip of the jacket or they button the jacket or they tie a bow in a rope which is wrapped around the subjects' waists. Tying a bow is our

favourite task because it describes both, a dressing task where subjects have to put on clothes and it simulates lacing shoes.

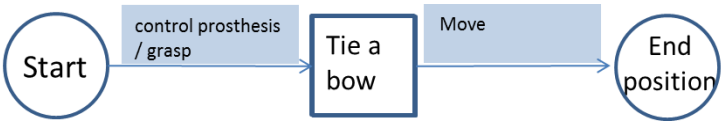

Figure 8: Sub phases of tying a bow

4 OUTPUT PARAMETER

For clinical evaluation of prosthesis users, normative data may be helpful to compare movement patterns and performance using different prosthetic devices. The normative group includes 20 able-bodied subjects performing chosen tasks to develop a set of normative data.

As objective output parameters for all tests and ADL movements we suggest the execution time, the numbers of failed trials and the joint angles extracted by motion capture system. To qualify the numbers of failed trials it seems plausible to calculate the error rate and express it in per cent like Scheme et al. recommend for an offline metric [10]. For the dual task situation it would be appropriate to capture the reaction time as well. For the SHAP -Test we calculate the IOFs. Additionally we will calculate APS to detect compensatory movements.

To capture the subjective impressions of the subjects we developed a questionnaire. The questionnaire asks the subjects for difficulties while performing the task, for their satisfaction with the prosthesis control and appearance of intentional movements. For the ADLs, SHELF-Test and dual task situation we got Likert scale based (7 grades) values which express the subjective difficulty in conducting a task and satisfaction with prosthesis control while performing the task. Furthermore, we got over all information about a specific prosthetic system when comparing several systems. In addition, the DASH questionnaire is used to provide subjective data of symptoms and functional status.

5 FINAL ADL TASKS SUGGESTION

This section is a summary of relevant ADL tasks which are suggested for clinical evaluation.

1. Lifting a tray and grasping objects
2. Carry a bag
3. Eating simulation with cutlery
4. Opening/ closing a jar
5. Tying a bow (Dressing task)

6 CONCLUSION

For the SHELF and SHAP-Test kinematic data are used to describe movement patterns of patients in order to detect compensatory movements. With the mentioned 5 ADL tasks (see section 5) we are able to present the capacity of the prosthesis control. We are going to provide a normative data set of these ADL movements and we will be able to compare later data for patient tests. From our viewpoint, these tasks include the mentioned challenges during the interview study and will help us to document the advantages of the pattern recognition approaching in an appropriate manner.

7 SUBCONTRACTING

Recruiting process was elaborated by our project partner OBHP (Otto Bock Healthcare Products GmbH, Kaiserstraße 39, Wien 1070, Austria).

The interview study mentioned in section 3.1 was conducted by our project partner UMCG (Academisch Ziekenhuis Groningen, Hanzenplein 1, Groningen 9713 GZ, Netherlands).

All of the other parts were done within the OSS by Fabian Unglaube, Andreas Kranzl und Barbara Pobatschnig.

8 LITERATURE

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9 APPENDIX

The following formula describes the questionnaire which is used to receive subjective information about control and handling of prostheses.

CASE REPORT FORMS (CRFS)

For Participant

RECRUITING

Participant´s ID: |__|__| __|__|

Randomization: |__|__|

Date, Name in block letters, Signature

RECRUITING General Questions I	
Participant´s ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

GENERAL QUESTIONS I

Date of Birth: |__|__| |__|__| |__|__|__|__| (DD / MM / YYYY)

Height: |__|__|__| cm

Weight: |__|__|__| kg

Gender: |__| Male |__| Female

Date of Amputation: |__|__| |__|__| |__|__|__|__| (DD / MM / YYYY)

Amputated Side: |__| left |__| right

Stump length: _____ cm

Reason for Amputation: |__| cancer |__| vascular disease |__| trauma |__| infection

|__| other:

.....

Currently fitted prosthetic hand:

.....

RECRUITING General Questions I	
Participant´s ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

Hours of wearing prosthesis

per day: |__|__| h

Do you have experience with pattern recognition? yes|__| no|__|

If yes: How long do you use the pattern recognition controlled prosthesis?

Other comments:

.....

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.....

.....

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

Project Specific Questions

Please rate the following activities concerning the control you experienced with the pattern recognition test prosthesis. For all answers, please consider only the quality of control of the prosthesis, not other prosthetic features (aesthetics appearance, shape, colour, weight, socket comfort, noise of the prosthesis).

Randomization prosthesis system (i.e. 1) : |__|

SHELF - Test								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	control/grasp	1	2	3	4	5	6	7
	manipulate/lower	1	2	3	4	5	6	7
	grasp/manipulate/lower	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How satisfied are you with prosthesis control while performing **this task**?	control/grasp	1	2	3	4	5	6	7
	manipulate/lower	1	2	3	4	5	6	7
	grasp/manipulate/lower	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

ADL 1: Moving a Tray								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	control/grasp	1	2	3	4	5	6	7
	lift/walk	1	2	3	4	5	6	7
	grasp/manipulate/release	1	2	3	4	5	6	7
	lift/walk/lower	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		Total satisfied	satisfied	Predominant satisfied	neutral	Predominant dissatisfied	dissatisfied	Total dissatisfied
How satisfied are you with prosthesis control while performing **this task**?	control/grasp	1	2	3	4	5	6	7
	lift/walk	1	2	3	4	5	6	7
	grasp/manipulate/release	1	2	3	4	5	6	7
	lift/walk/lower	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

ADL 2: Carry a Bag								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	Control/grasp	1	2	3	4	5	6	7
	Carry/fill	1	2	3	4	5	6	7
	Walk/lower	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		Total satisfied	satisfied	Predominant satisfied	neutral	Predominant dissatisfied	dissatisfied	Total dissatisfied
How satisfied are you with prosthesis control while performing **this task**?	Control/grasp	1	2	3	4	5	6	7
	Carry/fill	1	2	3	4	5	6	7
	Walk/lower	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

ADL 3: Cutting Movement								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	control/grasp	1	2	3	4	5	6	7
	cut/hold object	1	2	3	4	5	6	7
	release	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How satisfied are you with prosthesis control while performing **this task**?	control/grasp	1	2	3	4	5	6	7
	cut/hold object	1	2	3	4	5	6	7
	release	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

ADL 4: Opening/Closing a jar								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	control/grasp	1	2	3	4	5	6	7
	move/open/release	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How satisfied are you with prosthesis control while performing **this task**?	control/grasp	1	2	3	4	5	6	7
	move/open/release	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

ADL 5: Tying a bow								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	grasp							
	tie							
	release							
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		Total satisfied	satisfied	Predominant satisfied	neutral	Predominant dissatisfied	dissatisfied	Total dissatisfied
How satisfied are you with prosthesis control while performing **this task**?	grasp	1	2	3	4	5	6	7
	tie	1	2	3	4	5	6	7
	release	1	2	3	4	5	6	7
Were there any phases/movements of the task you were not satisfy with prostheses control?								
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

Dual Task Situation								
Control Difficulties		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How difficult was it for you to conduct **this task**? In which phase?	control/grasp	1	2	3	4	5	6	7
	manipulate/lower	1	2	3	4	5	6	7
	grasp/manipulate/lower	1	2	3	4	5	6	7
If mild difficulty – unable to control: Which phase/which movements? (open/close,flex/ex,rotup/rotdown)								
Control Satisfaction		No difficulty	Mild difficulty	Semi Mild difficulty	Moderate difficulty	Semi Severe difficulty	Severe difficulty	Unable to control 1
How satisfied are you with prosthesis control while performing **this task**?	control/grasp	1	2	3	4	5	6	7
	manipulate/lower	1	2	3	4	5	6	7
	grasp/manipulate/lower	1	2	3	4	5	6	7
Unintentional Movements		**Yes**	**If yes which and when?**					
Appeared any unintentional prosthetic movements?								

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

General Questions Regarding System |__|

		Highly confident	confident	Moderately confident	Mildly confident	little confident	Barely confident	Not confident
How confident did you feel with the control?		1	2	3	4	5	6	7
		Not at all	Rarely	Once in a while	Moderately	sometimes	Often	Very Often
How often have you experienced problems with inadvertent prosthetic movements?		1	2	3	4	5	6	7
If rarely – very often: Can you describe them?								
How often did the prosthesis not start moving properly?	Hand open	1	2	3	4	5	6	7
	Hand close	1	2	3	4	5	6	7
	Rotate up	1	2	3	4	5	6	7
	Rotate down	1	2	3	4	5	6	7
	Flexion	1	2	3	4	5	6	7
	Extension	1	2	3	4	5	6	7
	Key grip	1	2	3	4	5	6	7
	Fine Pinch	1	2	3	4	5	6	7

Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 | __ |

Randomization prosthesis system (i.e. 2) : |__|

Add all necessary questions from the prior part

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Questions Prosthesis System:	
Participant's ID |__|__| __|__|	D D M M Y Y Y Y Date |__|__| |__|__| | 2 | 0 | 1 |__|

Over All General Questions

	Strongly agree	Agree	Semi agree	Neither agree nor disagree Disagree	Semi disagree	Disagree	Strongly disagree
It was easy for me to understand the pattern recognition concept.	1	2	3	4	5	6	7
I want so switch permanently to pattern recognition.	1	2	3	4	5	6	7
I needed to concentrate to be able to control my prosthesis. System 1	1	2	3	4	5	6	7
Optional: I needed to concentrate to be able to control my prosthesis. System 2	1	2	3	4	5	6	7
Optional: I needed to concentrate to be able to control my prosthesis. System 3	1	2	3	4	5	6	7
I would like to permanently switch to system 1.	1	2	3	4	5	6	7
Optional: I would like to permanently switch to system 2.	1	2	3	4	5	6	7
Optional: I would like to permanently switch to system 3	1	2	3	4	5	6	7