Usability StudY Script/Protocol

|  |  |
| --- | --- |
| ID |  |
| Participant |  |
| Date |  |
| Conducting |  |
| First Activity | * Column with TM-PSS * Roof with Baseline * Column with Baseline * Roof with TM-PSS |
| Second Activity | * Column with TM-PSS * Roof with Baseline * Column with Baseline * Roof with TM-PSS |

# Preparation

## Main Experiment Checklist

|  |  |
| --- | --- |
| Equipment | Documents |
| * GoPro * SD Cards * Charging Cables * Tripod * Wrenches * TM-PSS device * Safety Vest * Hardhat * Gloves (S and L) * Compensation Materials | * Consent Form * Script * Check Lists – Included in Script * PSS Write-Up – Included in the script * Baseline Supporting Documents |
| Supplies |  |
| * Tape |  |

# Boxes content

|  |  |
| --- | --- |
| Box 1 – Column Assembly | Box 2 – Roof Assembly |
| * 1 x B-3 * 2 x A-6 * 1 x S-4 * 2 x A-9 * 5/8 bolts box   + 12 (+1) x 5/8 in bolts   + 12 (+2) x 5/8 in washers   + 12 (+1) x 5/8 in nuts * ½ bolts box   + 6 (+1) x ½ in bolts   + 12 (+1) x ½ in washers   + 6 (+1) x ½ in nuts | * 1 x B-8 * 1 x PS-3 * 1 x P-2 * 1 x PB-7 * 2 x Plate 2 * ½ bolts box   + 4 x ½ in bolts   + 8 x ½ in washers   + 4 (+1) x ½ in nuts * 5/8 bolts box   + 8 (+1) x 5/8 in bolts   + 8 x (+2) 5/8 in washers   + 8 (+2) x 5/8 in nuts |
| Box 3 – Tools and Miscellaneous | Box 4 – Spares |
| * Torque Wrench * Normal Wrench * Wrench Extension * Socket * GoPro * SD Cards * Charging Cables * Tripod * Wrenches * TM-PSS device * Safety Vest * Hardhat * Gloves (S and L) * Compensation materials | * Assemblies Spares * Bolts Spares |

# Participant Arrival

## Device Setup Commands

Set the correct scenario in the TP-PSS device and reset the device if needed.

## Welcome

Thank you for participating in this study. My name is RESEARCHER NAME, and I will guide you in this research study. I will provide instructions as the study progress, and I can answer any question you may have about any aspect of the study.

First, we will proceed to complete the Consent Form:

1. This form tells you a bit more about the study and why we are doing it.
2. This form also informs you that it is expected that this study to take around XX minutes
3. This study is considered minimal risk and as precaution you will use a PPE all the time
4. You will need to wear a PPE as much as you can. However, if you feel uncomfortable wearing any of it, such as glasses or gloves, you can remove it without any problem.
5. You can change your mind about participating in this study at any moment.
6. We will record you while doing the experiment.
7. Your information will be protected and de-identified so whatever of the results of the experiments will never single you out
8. In consideration of your time and effort, you will be compensated with \_\_\_\_\_\_.
9. If you have questions at any moment, please let me know
10. Please read and sign the consent form

\*\*Participant read and complete forms

Thank you, as it was mentioned before, you will need to use a PPE during the experiment. Please proceed to put on the PPE.

PPE includes:

* Gloves
* Glasses
* Vest
* Hardhat

\*\*Participant put on PPE

## Tool Training

Explain how to use Torque wrench

Let participant know that they can use multiple wrenches

Show him the graphic with the bolt parts

## After Participant put on PPE and Training

Thank you. Before proceeding, do you have any questions at this point?

Now, we will proceed to the first task of the experiment.

# First Assembly (TM-PSS Here for reference).

This will be randomized and balanced to minimize bias.

## Before Assembly

For this part of the experiment, you will complete a structural assembly while using a TP-PSS device to complete the assembly.

Please consider the following:

* You will communicate with THIS device for the activity to be done
* The work area for assembly is here, and all materials and tools needed for the assembly can be found here
* The part that is here is supposed to be fixed to the work table.
* All the pieces have a label where you can use to refer back to the instructions. The TM-PSS device also uses these labels in their instructions.
* Instructions about how to use the TM-PSS device. See example below:
  + Please ask a single question to TM-PSS device as it is not capable of managing multiple questions at the same time
* DEMO
* Indicate what will happen if device does not work. See the following example.
  + If the device does not understand what you said or it gives you the wrong instructions, please rephrase your command and speak clearly and slower.
* We, the researchers, will act as your supervisors, so if the TM-PSS device cannot help you given multiple question attempts, we can intervene and provide you with a correct answer to complete the assembly.

## During Assembly

I will proceed to start recording

\*\*Start Recording

You can start now.

**\*\* First part of the experiment starts**

**\*\* First part of the experiment Ends**

## After Assembly

Thank you! You can take a break if you need. Now we will use the computer to complete a survey about how you felt while completing this first task. This survey asks you to compare different parameters that affect your mental workload while completing the previous activity. You can remove gloves and glasses while completing the survey. Please let me know if you have any questions.

\*\*Complete survey on computer

LINK to NASA-TLX survey

\*\*Stop Recording

## Checklist 1 – Experiment – Part 1 - Example

|  |  |  |
| --- | --- | --- |
| **Action** | **Done?** | **Observations** |
| Assmebly? Roof or Column? | Roof |  |
| Support System? TM-PSS or Baseline? | TM-PSS |  |
| Tool set to right torque | Yes |  |
| Experiment Assembly Completed? | Yes |  |
| No missing pieces on assembly | Yes | Plates 2 were not placed |
| No missing bolts on assembly | No |  |
| Bolts to be torqued were torqued | Yes |  |
| Bolts are correctly installed.  No missing washers or nuts | No | Missing 2x1/2(small) washers |
| Take pictures ofcompleted assembly | Taken |  |
| **Interventions**   1. Participant asked about how to place PB-7. I explained he should place top bolt first | | |
| **Rework**   1. Participant is missing whashers in 5/8 (big) bolts. – Fixed | | |
| **Notes**  1 – TM-PSS failed to start 2 times at the beginning of the experiment. After this, performance was acceptable  2 – Participant strgled to place PB-7 | | |

# TM-PSS Write Up for Column Assembly

1:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  2:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  3:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  4:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  5:  { text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

# TM-PSS Write Up for Roof Assembly

1:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  2:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  3:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  4:  {text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

  5:  { text: "This is an example of possible commands, code, or interaction outcomes expected for the TM-PSS. In the case TM-PSS fails, this will help the researcher to still complete the assembly process",

# SECOND ASSEMBLY – (bASELINE FOR REFERENCE)

The order of assembly and PSS used will depend on scenarios.

## Preparation

* Place assembly in place
* Be sure that supporting material is placed correctly

## Before Assembly

This is another assembly that you will complete, but you will use a different support method. In this case, you will use paper instructions only (this is an example).

Please consider the following:

* The work area for assembly is here, and all materials needed are also in this location.
* The part that is here is fixed to the work table.
* All the pieces have a label that you can use to refer back to the instructions.
* The paper instructions will be fixed in THIS location in the lab. This means that if you need to get more information about the assembly you need to stop doing what you are doing and walk to the location to see the instructions, then you can continue with the assembly.
* We are taking the role of your supervisor, so if the instructions are not helping you complete the assembly and you think you need some help, we can intervene and help you if you clarify a simple question.

## During Assembly

I will proceed to start recording

You can start now

\*\*Start Recording

**\*\* Second part of the experiment starts**

**\*\* Second part of the experiment Ends**

## After Assembly

Thank you!

You can take a break if you need.

You can now remove the PPE.

\*\*Participant removes PPE

\*\*Stop Recording

Now we will use the computer to complete a survey about how you felt while completing this second task.

This survey asks you to compare different parameters that affect your mental workload while completing the previous activity. Please let me know if you have any questions.

\*\*Complete survey on computer

LINK to NASA-TLX survey

## Checklist 2 – Experiment – Part 2 - Blank

|  |  |  |
| --- | --- | --- |
| **Action** | **Done?** | **Observations** |
| Assmebly? Roof or Column? |  |  |
| Support System? TM-PSS or Baseline? |  |  |
| Tool set to right torque |  |  |
| Experiment Assembly Completed? |  |  |
| No missing pieces on assembly |  |  |
| No missing bolts on assembly |  |  |
| Bolts to be torqued were torqued |  |  |
| Bolts are correctly installed.  No missing washers or nuts |  |  |
| Take pictures ofcompleted assembly |  |  |
| **Interventions** | | |
| **Rework** | | |
| **Notes** | | |

# Post-Experiment Interview

Now, I will have a quick interview with you about your experiences in both tasks of the experiment. The interview will be recorded.

\*\* Start audio recording of the interview.

## Interview Questions

* What do you think paper instruction was better for?
  + What do you think paper instructions were not good at?
  + While using the paper drawings, to what extent were you aware of your surroundings? From scale 1 -10.
* What do you think the TM-PSS device instructions were better for?
  + What do you think the TM-PSS device instructions were not good at?
  + While using the TM-PSS device, to what extent were you aware of your surroundings? From scale 1 -10.
  + More specific questions about aspects of TM-PSS being studied.
* Did you have any problems with any of the support systems?
* What assembly was easier to do? (Expecting assembly responses, not systems)
* What support system, paper or smart device, was easier to use?
* What support system, paper or smart device, do you think makes you do the assembly more efficiently?
* Have you had any experience with voice assistants before?
* Do you think voice instructions might improve workers' productivity if used in the field?

That’s the end of the interview.

# End of Experiment

This also finishes the experiment. Thank you very much for your participation.

## Compensation

Give compensation material or provide instructions for compensation.

This concludes the experiment. Thank you again.