

User Preferences Regarding Body Support and Personal Hygiene in the Toilet Environment

Dries DEKKER , Sonja N. BUZINK and Johan F.M. MOLENBROEK¹
*Delft University of Technology – Faculty of Industrial Design Engineering –
Section Applied Ergonomics and Design, Delft, The Netherlands*

Abstract. In the development process of the friendly restroom, information was needed about user preferences regarding supports and personal hygiene in the toilet. As literature studies did not yield the required information, two user tests were held with supplemental questionnaires. The main test was carried out with seniors, the preliminary test with students. The preliminary test helped to fine tune the main test and to assess its risks. The test was held with a setup that consists of an height adjustable toilet bowl and various adjustable supports around it. The setup also contained a newly designed washbasin. The results from this study are a preliminary insight in the preferred types of supports and corresponding preferred heights and positions for these supports among elderly. Furthermore, insight was acquired in attitudes towards personal hygiene in the toilet.

Keywords. User Preferences, Personal Hygiene, Body Support, Toilet, Seniors, User Test

1. Introduction

In the development process of the friendly rest room within the FRR project, detailed information was needed about the positioning of supports in the toilet environment and a newly-designed washbasin with a sprayer and blow-dryer for perineal cleansing. Literature study showed that currently no guidelines for applying appropriate support facilities in toilet environments exist [1,2]. It was therefore decided to execute two studies to gain insight in the use, preferred placement and acceptance of and need for different types of supports and a new design for a washbasin and its aids for perineal cleansing, both for private and semi-public toilet environments [3,4].

The objectives of these studies were:

- To gain insight in the use of supports during the toilet ritual,
- To determine the range of preferred positions of supports for sitting down on and standing up from a toilet, both relative to the body and absolute,
- To determine the preferred type of support and the usefulness for each type for standing up from, sitting down on a toilet and during wiping of the buttocks,

¹ Corresponding Author: Johan Molenbroek; Address: Delft University of Technology; Address: Landbergstraat 15, 2628CE Delft, The Netherlands; Email: j.f.m.molenbroek@tudelft.nl

- To verify whether familiarity with supports in the toilet environment is related to the preference for a particular type of support,
- To gain insight in the attitudes towards several methods of perineal cleansing, both in private and semi-public toilet environments,
- To determine the need for the newly-designed washbasin, both in semi-public and private situations,
- To gain insight in the use of the newly-designed washbasin for washing hands
- To determine the range of positions of the washbasin for washing hands comfortably.

2. Method

2.1. Subjects

In order to gain insight in the use of the washbasin and supports and to fine-tune the test set-up, a pilot test was done with five students of the Faculty of Industrial Design Engineering of the Delft University of Technology. During this test, the students wore an old-age simulation kit (see Figure 1). The pilot test was held with students, because students are more readily available than the actual target group of seniors and to avoid exposing the seniors to unknown risks of the test equipment.

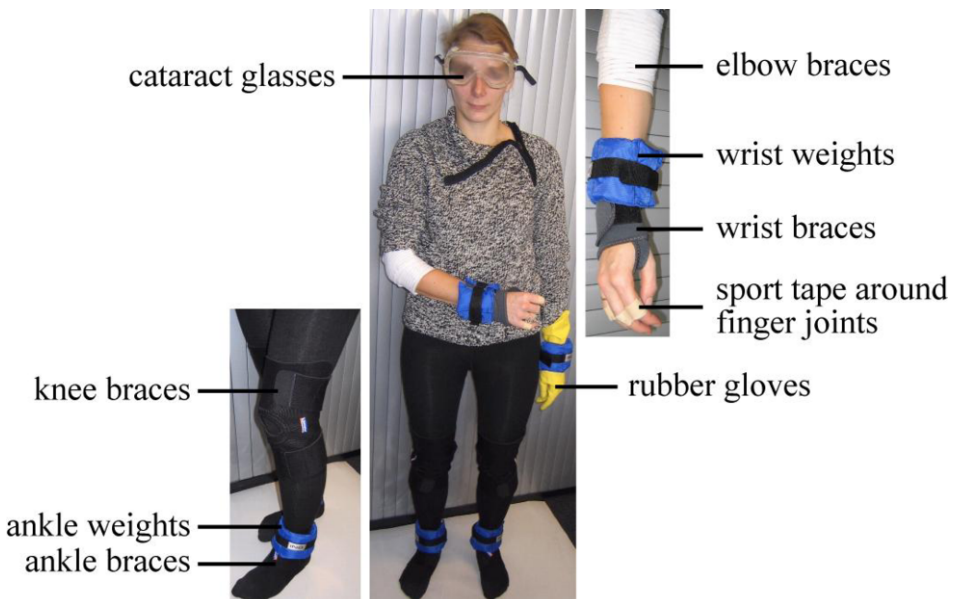


Figure 1. Student wearing the old-age simulation kit

The main study was held with fourteen persons from 58 to 78 years of age after the test was fine tuned and evaluated in the preliminary test. The senior subjects were asked to fill out a questionnaire about their experience with supports in the toilet and to record their home situation. The subjects of both studies were asked to demonstrate several specific activities of the toilet ritual in the simulated toilet environment.

2.2. Equipment and Environment

The test equipment consisted of a toilet bowl, several adjustable supports and a prototype of the washbasin for both tests. The toilet bowl was hydraulically height-adjustable over a range large enough to accommodate all subjects, thereby eliminating the possible influence of a fixed toilet height. The students in the pilot test wore an old-age simulation kit during the test.

2.2.1. The Old-Age Simulation Kit

When ageing the joints in our body tend to get stiffer and our senses deteriorate. In the student test this process was simulated by applying braces around wrists, elbows, ankles and knees, and sport tape wrapped around fingers to reduce the agility. To reduce the sensory perception, cataract-simulating glasses were incorporated in the kit and the students wore rubber gloves. Finally, weight belts were attached to the wrists and ankles to simulate deterioration of muscle strength. The kit is illustrated in Figure 1.

2.2.2. The Support Configuration

The support configuration consisted of a frame with three types of supports: two vertical supports, a front support, and two side supports. Both the front support and the side supports were adjustable in height from just above the toilet up to 1800 mm from the floor. The distance between the side supports was fixed at about 700 mm. In the test configuration with the elderly people, the distance between the toilet seat front and the vertical supports was adjustable from 120 mm to 580 mm, see Figure 2.

After measuring some anthropometric variables, the subjects were asked to stand up and sit down using the three types of supports successively. The supports were placed around the toilet in the following order: first the vertical supports, then the front support, and finally the side supports. Each type of support was tried in different positions (three for the students and two for the elderly), based on the anthropometric data of the subjects. The purpose of these variations was to let the subjects feel the effect of different support positions on their comfort-level during standing up and sitting down. After these trials, they were asked to indicate an optimal position for the different types of supports.

The elderly were asked to pretend to wipe their buttocks with a piece of toilet paper to find out how each type of support would be used during this activity. This is an activity with an elevated risk for falling, because a shift of the body's centre of gravity is needed.

Finally, with all types of supports present and in their most comfortable positions, the subjects were asked to indicate which of the supports provided the most comfortable assistance when sitting down, standing up, and wiping their buttocks.

2.2.3. The Washbasin Prototype

The usage and acceptance of a new washbasin design was investigated by testing a wooden prototype. Afterwards the test users were interviewed with a questionnaire, especially made for this purpose. Use situations, often regarded awkward for toileting and cleansing is a sensitive topic, were represented in this questionnaire by friendly drawings. In this way test users were not confronted with blunt text or the need the phrase themselves, just pointing would suffice.

The washbasin prototype was adjustable in height and horizontal position, however was not connected to the water supply.

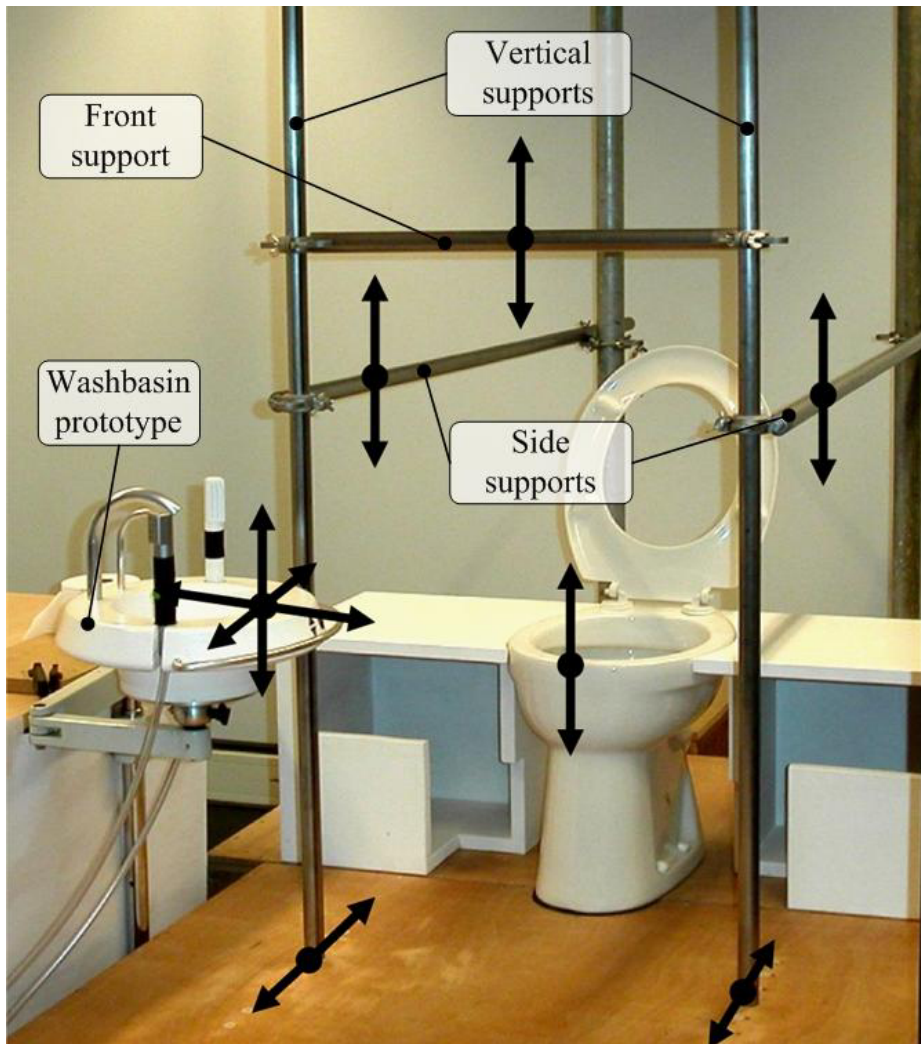


Figure 2. The toilet environment and its adjustability in laboratory at TU Delft

The students were asked to show how they would cleanse themselves after defecating, how they would clean a small plastic bag (representing a stoma), how they would wash their hands seated as well as standing. They had to do this using the washbasin including the sprayer and the dryer. The student test revealed that the washbasin prototype needed more detail for usability testing. After the students' test, the focus of the test set-up was changed from usability to acceptance and the attitude towards the newly-designed washbasin. The students had to find out how to use the washbasin on their own to verify whether they understood the functions and given use-cues.

Before the test with the elderly subjects, all the functions of the washbasin were explained to the subjects. By ensuring that the elderly subjects understood all the functions of the washbasin and its aids in their test, it was possible to ask the subjects their opinion on these functions.

The elderly were asked to pretend to cleanse themselves after defecation with the available equipment on the washbasin. Following they were asked to pretend to wash their hands, both while seated and standing (see also height-adjustable washbasin in Figure 2). Finally, the elderly were asked for their opinion about the washbasin, for use at home as well as in a semi-public toilet environment.

After the prototype tests, all subjects were asked to fill in a questionnaire about their experience with different cleansing methods and their attitude towards these methods, both in private and semi-public situations. The elderly were also asked to fill in a questionnaire concerning common postures and cleansing methods in a semi-public toilet environment.

3. Results

In general, all subjects used the supports two-handed with a power grip (see Figure 4) . The most common way of applying force was by pulling or hanging, except for the side supports to which a pushing force was more frequently applied. The difference is illustrated in Figure 3.

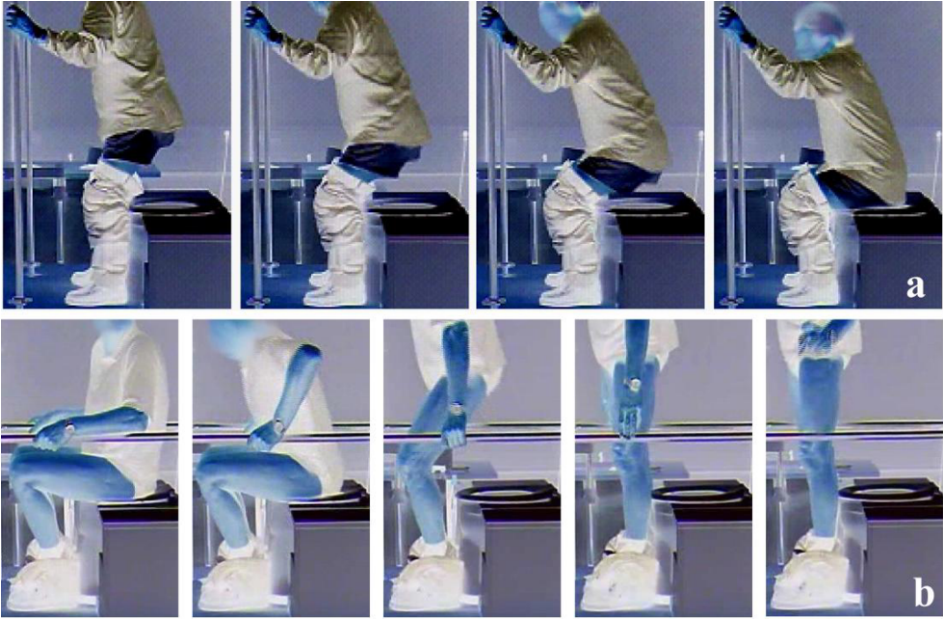


Figure 3. Common way of sitting down using the vertical supports by a senior (a) and a typical sequence for standing up with the side supports by a senior (b)

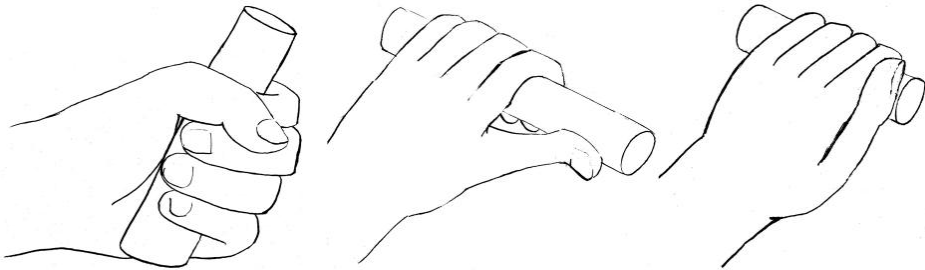


Figure 4. Power grip, thumb grip and hook grip respectively

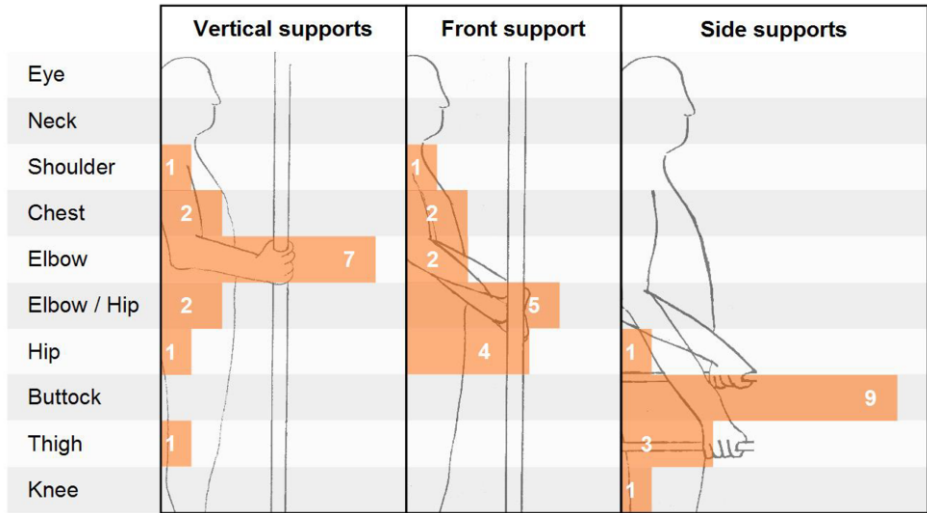


Figure 5. Body-related preferred heights of support for the elderly subjects

3.1. Vertical Supports

The subjects most frequently grasped the vertical supports at elbow height while standing. The elderly showed a lot of variety in grip posture, as can be seen in Figure 5. Generally, the subjects did not change the positions of their hands between sitting down and standing up.

3.2. Front Support

For the front support, most of the subjects considered a position slightly lower than elbow height while standing as most comfortable. The range was a bit narrower than for the vertical supports, as can be seen in Figure 5. As with the vertical supports, most subjects prefer to pull or hang to stand up and sit down using the front support. The support was held at about shoulder height while sitting by all subjects.

From comments by and observation of the subjects, the front support appeared to have some practical and psychological disadvantages. Some subjects nearly bumped their heads against it, while others said to feel confined by it.

3.3. Side Supports

Most students liked the side supports best when they were placed at elbow height while sitting. The elderly mostly preferred them to be at buttock height while standing, as can be seen in Figure 5. This is lower than the heights considered comfortable for the other types of supports. In contrast to the other types of supports, a pushing force was used more often for sitting down and standing up with the side supports, as illustrated in Figure 3b.

3.4. Correlation of Preferred Positions of the Supports and Anthropometrics

The subjects were asked for the optimal heights of the three types of support for sitting down on and rising from the toilet. The heights of all supports were adjustable. The depths of the vertical and horizontal front supports were adjustable only in the test with the elderly subjects. The depths were measured from the front of the toilet seat and the heights from floor level. No strong correlations were found between the measured anthropometric dimensions and the preferred positions, as is illustrated in Figure 6.

3.5. Preferred Type of Support

When subjects were asked to choose between the different types of support, both students and elderly preferred the vertical support most frequently for standing up and sitting down, as shown in Figure 7. If stability is needed during use of the toilet, for example for wiping, the side supports also provide a good solution according to many elderly subjects.

3.6. Relation between Familiarity and Preference Supports

The elderly were interviewed at home prior to the experiment in order to investigate to what extent they were familiar with supports in the toilet environment and to record their home toilet situations.

Familiarity with supports was mapped in order to verify whether there are relations between the familiarity with and the preference for a specific type of support. The results show that familiarity has a significant relation with preference as the five subjects familiar with supports favour the vertical supports for standing up and sitting down.

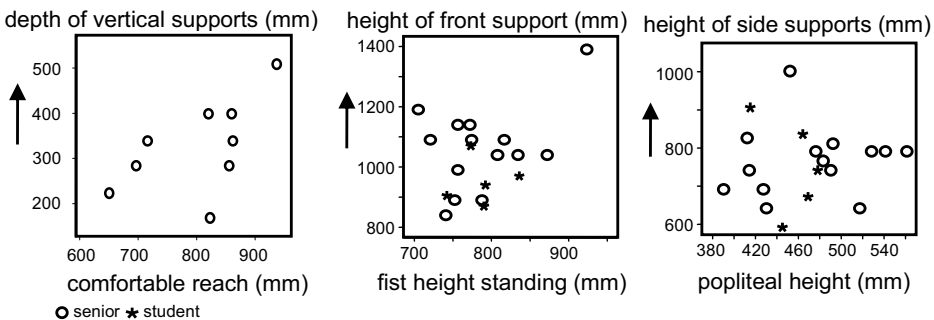


Figure 6. The preferred depths are measured from the toilet’s front and the preferred heights from floor level

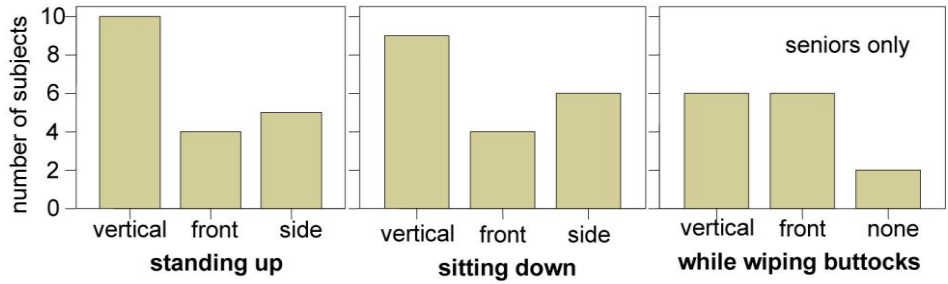


Figure 7. Preferred type of support for three phases in the toilet ritual

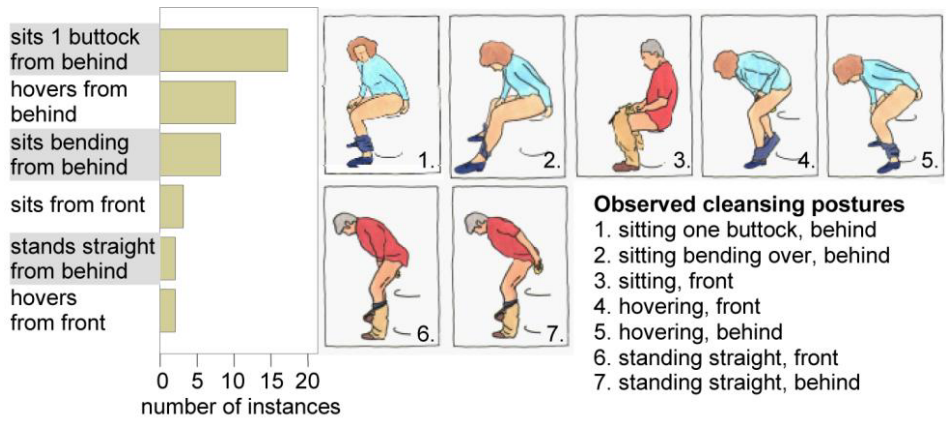


Figure 8. Different postures of elderly wiping their buttocks with toilet paper



Figure 9. Different postures while cleaning with the hand sprayer

3.7. Personal Hygiene

Both the student and elderly subjects were asked to pretend to cleanse themselves with the aids available on the washbasin prototype. This resulted in a lot of different postures, as illustrated in Figure 9. As the washbasin prototype was not functional, the illustrated postures are only valid to indicate the variety of postures that will be used. On three moments during the test, the fourteen elderly subjects were asked to demonstrate how they would apply toilet paper for cleansing after defecation.

A total of seven combinations of postures and approaches for application were identified, which are represented in Figure 8.

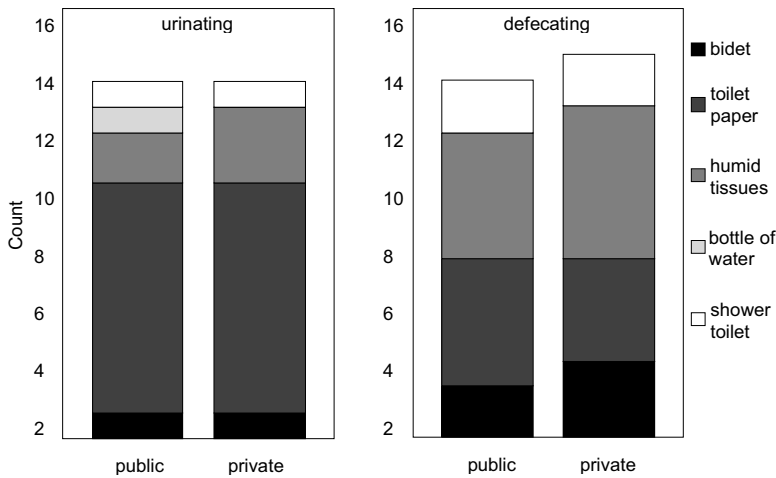


Figure 10. Seniors' preferences for cleansing aids after urinating and defecating



Figure 11. Different strategies for raising the washbasin

3.8. Preferences for Perineal Cleansing

Although the aids for perineal cleansing on the washbasin were accepted better than expected, the answers given by the subjects show that more traditional methods of cleansing (in the Netherlands, toilet paper or wet tissues) are still most preferred by the subjects, see Figure 10. Some elderly prefer a combination of dry toilet paper and wet

tissues, while others prefer the bidet or hand-sprayer for perineal cleansing. Wet tissues are especially popular after defecating.

All students stated to prefer toilet paper for perineal cleansing after defecation and urination, although almost all of them say to use the hand-sprayer when no alternative is at hand.

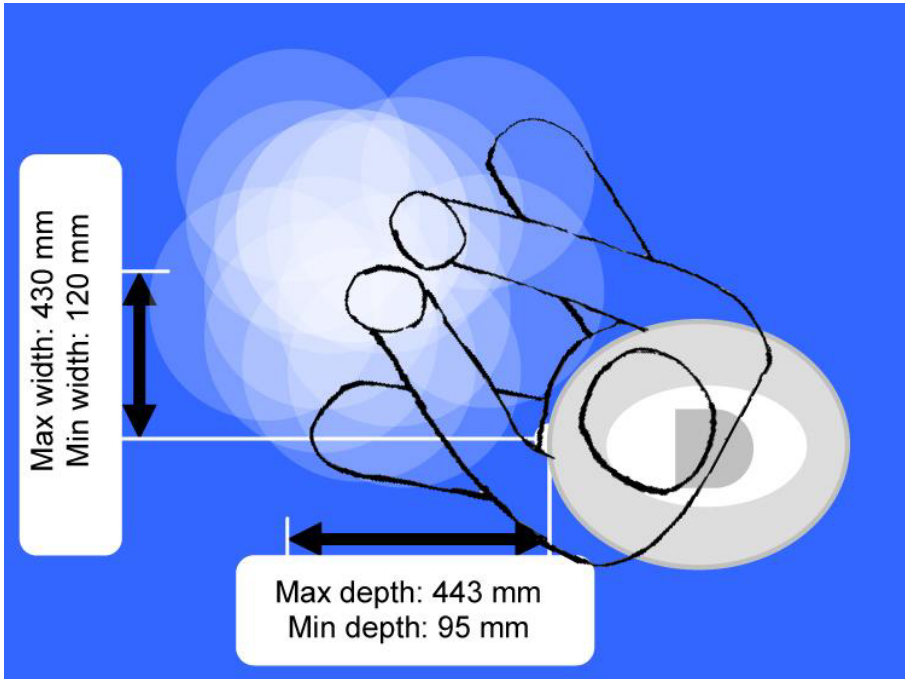


Figure 12. Positions of the washbasin chosen by the elderly for washing hands while seated

Unexpectedly, it seems that students are not as open to new concepts for perineal cleansing as the elderly. The students state only to want to use a sprayer-dryer combination when no alternative is at hand. The difference could be explained by the fact that the students were only asked about their attitude in semi-public situations and that the elderly were questioned about both private and semi-public situations.

3.8.1. Using the Washbasin for Washing Hands

The subjects were asked to pretend to wash their hands, both while seated and standing, and to put the washbasin in the most comfortable position for this activity. The washbasin was considered somewhat small, and the sprayer and the dryer on the sides limited the space to move the hands.

In the students' test, the most frequently used method for moving the washbasin up is by manipulating the handle in front of the washbasin see also Figure 11. The rubber buttons, originally intended for this operation, were used as well, and one subject tried to lift the whole of the washbasin to elevate it. The students' test also revealed the lack

of sufficient contrast between the washbasin parts. This will create problems especially for the visually impaired.

All subjects were able to find comfortable positions for washing the hands, both in sitting and standing posture. Some students stated to be too impatient to raise the washbasin to a comfortable height for a short activity like washing hands. The total heights' range of the test of the elderly subjects varies between 470 mm and 1090 mm.

It was expected that the elderly would prefer to place the washbasin over their lap or between their legs, as this position allows a more relaxed posture during hand-washing. This appeared not to be true as can be seen in Figure 12.

4. Conclusions

The studies resulted in several very valuable answers to questions of the designers on the usage of supports within the toilet ritual, in addition to information on the acceptance and usage of the newly-designed washbasin. The conclusions that can be drawn from these studies are that the test users:

- Prefer vertical supports for standing up and sitting down,
- Consider the washbasin to be a valuable addition to the FRR toilet, but needs further development.

5. Recommendations

One of the most interesting topics for future study is the description of comfort and discomfort zones for the positions of the supports around the toilet, and whether there is a relationship between the boundaries of these zones and anthropometry. In a similar study, the influence of different types of support around the toilet on the sit-to-stand and stand-to-sit motion could be investigated. An analysis could be made of the influence on the trajectory of the centre of gravity, for example. This could eventually lead to the developments of supports in the toilet environment that better suit the variation of the human anthropometry for the sit-to-stand and stand-to-sit motion.

Another interesting topic for future study regarding the use of the washbasin and its cleansing aids could be a real-life test of the functional cleansing aids on the washbasin when used for perineal cleansing. Most subjects in this study were not used to perineal cleansing using water. Therefore, it is also considered advisable to perform a longitudinal study in which the washbasin design and the aids for perineal cleansing are tested. This gives the usage of the 'new' aids for perineal cleansing a chance to evolve to a more automatic activity, like cleansing by toilet paper currently is for most Dutch people.

The subjects in this study were mobile enough to come to the test facility. Therefore, the difference in behaviour and opinion between elderly people with more limitations and the subjects in this study could be verified.

At the same time, still more data needs to be collected on common toilet habits and preferences concerning perineal cleansing, especially those of the elderly.

Finally, one of the challenging aspects of this study was the issue of ethics. It would be very valuable to develop methods of user research in the toilet environment

or other taboo areas without compromising the privacy of the participating subjects and the concept of informed consent. These methods should ideally yield the same information as unobtrusive, observational user tests.

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