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Considerations on sleeping in long haul flights

Abstract

Most long-haul passengers want to sleep but experience the economy class as uncomfortable. This study explores dimensions of beds and using flat beds in economy class by using the space of four seats and replace these with stacked beds. While feasible, key challenges include safety during taxi, take-off and landing, comfort while using devices, and difficulty getting into the beds. A pilot test with a low fidelity prototype showed that passengers could access the beds, but privacy and space issues are more an issue. The study concludes that, besides seat and bed design, sleep quality also depends on recline angle, temperature, noise, and lighting—factors that airlines should consider.

Keywords: long haul flights, flatbed, environment, airlines

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Introduction

Eighty percent of the air travellers like to sleep on long haul flights.[1] However, the majority of passengers rate the comfort while sleeping very low.[1] There are many factors influencing sleep quality while travelling. Bouwens et al.,[1] mention seat, noise, temperature, light, smell and vibrations. He and Vink.,[2] mention also that preparation is important, proper preparation might create mental security, and help passengers getting into a good sleep. Vink et al.,[3] found that having a good nap is not only influenced by the physical support or angle of the back rest, but factors like blankets, sleep environment and way of awakening have an influence as well on the perceived sleep quality. Research shows that the comfort while sleeping is rated highest sitting in a seat with a backrest angle of 140 degrees or more or lying horizontally on a flatbed.[4] This flatbed is now often available in business class. However, for airlines to be economically viable it is important to limit the space occupied by beds to have as much paying passengers as possible within an aircraft. For a flatbed, a study of Smulders and Vink.,[5] the dimensions of a flatbed were discussed based on research. The bed dimension 171 × 76 cm might be sufficient as it results in a reasonably good sleep tested with 41 participants in a full night sleep. This is possible as most of the time people sleep sidewards. In a study of Vink et al.,[6] among 189 participants 74% of the time people slept on the side. Converting a row of four seats with a 32" pitch to a flatbed might be possible as 32" is 81 cm, which enables an 81 cm wide bed. That is why for the Flying V a design was made where three beds were placed on top of each other[2] in the space a normal four seater is placed (Figure 1).

Figure 1 the beds as they are designed for the Flying V taking the space of three seats (left). The Flying V aircraft (right).

The width of a four seater in an aircraft can vary but is approximately 72" (=183 cm). That means that in principle the space of a flatbed replacing a four seater is 183x81 cm, which allows a reasonably good sleep as we follow the research of Smulders & Vink.,[5] In this way if passengers are willing to pay 4/3 of the price they good sleep for almost economy class prizes and airlines have something special to offer. However, the bed as shown in

Figure 1 has at least three important problems:

a) During taxiing, take-off and landing (TTL) it is not allowed to lie flat.

b) When passengers do not sleep they like to watch television or use their smart phone.

c) It is unknown whether passengers can get into the bed or out of the bed.

For problem 1 for the Flying V the solution was developed that the middle bed can be moved up. And the sides of the lowest bed can be flipped down (Figure 1) and this did work. In evaluating it appeared that the position during TTL is not that comfortable as the participants experienced the back rest too much upright. On the other hand, they reported much lateral space (three persons occupy a four seater) and said that they were willing to have less comfort for a short part of the journey and a good sleep for the larger part.[7]

For problem 2 an experiment was carried out.[8] In this experiment 52 participants were asked to use a smartphone on a bed and the trunk angle of this bed was adjusted to 6 positions from flat to upright (Figure 2) and for each angle the comfort and discomfort was recorded. The results showed that the participants prefer a trunk angle range around 120 and 142 degrees. With an angle of 140 degrees there is still enough space to move the head for a p95 person in the design of Figure 1. So, a bed with an adjustable headboard facilitates comfortable use of a smart phone. In this position it is also possible to watch a screen which is mounted to the ceiling.

For problem 3 an additional experiment is carried out, which is reported in this paper. The research question is are passengers able to climb into a bed as shown in Figure 1. In Figure 3 a ladder is shown, which could help participants to get into or out of the bed. It appeared that the lowest and middle bed were most problematic to get into.[7] Therefore, a small qualitative pilot study was done,[9] where passengers were asked to get into the lowest bed. The research question was: is it possible to get into the bed without ladder and what is the comfort experience.

Figure 2 The positions tested in using a smart phone.

Figure 3 A ladder can be pulled out between the beds to get into the bed.

Method

To answer the research question, 11 participants (6 males and 5 females, 20–65 years, with no known musculoskeletal disorders or mobility impairments that could affect climbing or physical performance) were asked to climb into a bed and get out of the bed. The bed was positioned at a height of 70 cm and the dimensions mentioned above were applied. The height of the bed space was 70 cm as well. The sleep box was a very low fidelity carton box reinforced with wood. The eleven participants were asked to climb in and out and there was no space restriction around the area where participants could climb into the bed. Data were collected using direct observation and short post-task interviews. During the trials, researchers manually recorded each participant's actions while entering and exiting the sleep box, focusing on posture, movement sequences, and any visible indications of physical effort or hesitation. Observations were documented in real-time through written field notes; no video or audio recordings were used. The process was noted. After getting in and out, participants were asked to rate the comfort on a scale from 1-7 (1=no comfort at all and 7=extreme good comfort) for questions on overall comfort, convenience to enter the cabin, leaving the cabin, spaciousness in opportunity to sleep. Additionally, participants could give comments on their experience. All data collection procedures followed the same protocol to ensure reliability and comparability of results.

Results

The observations showed that all participants were able to get into the bed and leave the bed. Also, the oldest person (65 years) was able to easily get in and out. In Table 1 more detailed descriptions of the observations are shown. In Table 2 the answers to the questions are shown. In the interviews it was clear that the ability to lie flat was appreciated by all 11 participants. The comfort score was relatively high (avg 6.2 on a scale 1-7). The convenience getting in and getting out was rated relatively low (avg 3.7 and 4.5 respectively), which probably influenced the overall comfort (avg 4.4). In the open interviews 5 out of 11 mentioned the darkness in the box. They preferred to have more light in the sleep box. An interesting observation was made[9]: while entering the sleep box a lot of participants (7 out of 11) would sit on the bed first and subsequently curled their back to lay down (Table 1). This was an unexpected result, as it was expected that participants would dive in with their head first, facing down. Another observation made was that while leaving the cabin, the feet of the participants do stick out quite far. Especially, those that climb out of the bed laying on their back (6 out of 11). The problem with this is that the feet need more space than the aisle width, which might cause issues with passengers sitting at the other side of the aisle. Another observation was the fact that three females that were wearing dresses or skirts mentioned in the interviews that they didn't feel comfortable climbing in and out while other persons watch.

Table 1 Results of the observations

Observation results climbing in	**Number of participants**
"The person stood with the back to the sleep box, grasped the bedframe with two hands at the area where the feet would lie, then lifted the body and would sit on the edge of the bed where the feet would lie. Then the person curled the trunk to the right side and placed the head in the box, then the person would crawl in the box on the back and move to the end and took the preferred sleeping position laying on the side."	3
The same as previous but 'grasped the bedframe with one hand"	1
The same as the first one but 'curled their trunk to the left side'	2
The same as the first one but 'the preferred sleeping position laying on the back'	1
"The person stood with head to the sleep box with bended legs, placed both hands in, then placed the head in the box, stretched the legs and the body would go further in the box, then the person crawls further in the box and in the end took the preferred sleeping position laying on the side."	3
The same as the previous one but 'lying on the back'	1
Observation results climbing out	**Number of participants**
"The person crawled lying on the back to the opening, the legs first are stretched and the feet and lower leg start to stick out of the box, after some time the trunk raises a bit curled to the right the head then comes out and the legs bend and the person glides out of the box until the feet touch the ground and then the body is straightened"	4

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Table 1 Continued....

The same as previous but ' a bit curled to the left "	1
"The person turns the body with the head facing down (lying on the belly), then crawls to the opening, the feet stick out rather far. At a certain moment the legs flex in the hip and the legs go downward and will reach the floor, then the trunk curls out of the box"	6

Table 2 Average comfort scores of the 11 participants on the questions (1=no comfort at all and 7=extreme good comfort)

Question	Average comfort score (SD)
overall level of comfort	4.4 (1.1)
convenience while entering the cabin	3.7 (2.4)
convenience leaving the cabin	4.5 (2.0)
comfort related to speciousness while in the cabin	5.4 (1.4)
opportunity to take the favourite sleeping position	6.2 (1.1)

Discussion

Before the test, the main question was if passengers would be able to climb in the sleep box. However, in doing the test other problems were seen as more problematic by the participants, like the feet using more space than the aisle width would allow and privacy issues wearing skirts and dresses. This shows the value of user research with low fidelity prototypes. Virzi.,[10] already mentioned in 1989 advantages of using low-fidelity prototypes early in the design phase.

Regarding the design of sleeping possibilities in aircrafts in the current situation it might be more useful to look at the dimensions for a flatbed in business class as mentioned in the introduction (171 × 76 cm) and maybe for the other classes to look at the environment which supports a good sleep in a seat where the back rest can be reclined more than 130 degrees. A previous study among 40 participants[3] showed that it is important to have a dark environment, a cool environment for the head and warm for the rest of the body by for instance blankets. A *"silent"* room was also often mentioned for a good sleep. In another study[11] on long haul flights, 25% mentioned that the environment (temperature, light and engine noise) is the dominant factor for a good sleep. This means that apart from a recline of more than 130 degrees, attention is needed for the temperature, light and noise in vehicles. Caddick et al.,[12] report the importance of the environmental factors. They report that noise in the sleep environment should be reduced to below 35 dB, the optimal ambient temperature ranges between 17° and 28°C and complete darkness is optimal for sleep.

Conclusion

Providing flat beds in economy class for long-haul flights is technically feasible and could significantly improve passenger comfort while sleeping. While challenges remain—such as space constraints, safety during taxiing, and privacy concerns—user testing has shown that passengers can enter and exit compact sleep pods and value the ability to lie flat. Adjustable headrests and environmental factors like darkness, quietness, and appropriate temperature are also critical for quality rest. With thoughtful design, airlines could offer in future a more restful experience in economy class without compromising cabin density.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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