JDC-BROOKDALE INSTITUTE
OF GERONTOLOGY AND HUMAN DEVELOPMENT

Adapting the Chair Adapting the User

Ilana Mizrahi • Bernard Isaacs • Tamara Barnea
Netta Bentur • Ariel Simkin

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Adapting the Chair, Adapting the User

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שם המחבר אילנה מ, ברנרד א, תמרה ב, נטה ב, אריאל ס.

שם הספר מתאימים את הכיסא, מתאימים את המשתמש.

שם השואל	תאריך	החזמה

Adapting the Chair, Adapting the User

Consumer research and testing improve product design and help to identify the market.

BY ILANA MIZRAHI, BERNARD ISAACS, TAMARA BARNEA, NETTA BENTUR, & ARIEL SIMKIN

HOW MANY TIMES DO YOU get up from a chair every day? You probably never even think about it. Yet for the elderly and people with disabilities – especially those with chronic illnesses affecting their lower limbs – getting up from a chair is not easy (Kerr et al., 1991; Wheeler et al., 1985). According to the U.S. Department of Health and Human Services, in 1991, 8% of all U.S. elderly found rising from a chair difficult, yet the ability to do so is viewed as crucial for an elderly person's independence.

In this article, we discuss the contribution of consumer research to the development of an assistive chair for the elderly and those with disabilities – the Hi-Riser Chair. We focus on consumer input to designing the chair, guidelines on how to use it, and several aspects of planning a marketing strategy.

Design Considerations

In designing an assistive chair that enables people who are elderly or have disabilities to sit and then rise with greater ease, two things must be considered. The first is adapting the chair to address difficulties encountered by users when rising or sitting. Primarily, elderly people have problems shifting their center of gravity in order to rise – that is, lifting their body weight forward (during the preparatory stage) and bringing themselves to a standing position (during rising). For example, a chair with a seat back pitched at a severe backward angle makes it more difficult for users to move their weight forward, and a chair with a low seat causes problems when users attempt to lift themselves to a standing position (Rodosky et al., 1989; Wheeler et al., 1985).

The Hi-Riser Chair can assist some elderly people to rise and sit with ease.

Improved chair design can compensate for these difficulties but is not enough to ensure successful use. Designers must also take into account the need for elderly users to adapt to the chair. Rising and sitting with the help of a specially designed chair requires that the elderly relearn activities they once performed automatically. Understanding how they will learn to use the assistive chair is crucial to its design. The involvement of elderly consumers in the development and design process is therefore essential.

The Study and Its Aims

A multidisciplinary research team comprising a geriatrician, a biomechanical engineer, a technician from the manufacturing team, and researchers in the fields of gerontology, rehabilitation, and consumerism for the elderly conducted the study at the JDC-Brookdale Institute of Gerontology in Jerusalem. The aims of the research were twofold: to assist the manufacturer in developing an assistive chair and to learn more about the process by which elderly people learn to use an assistive device.

The Hi-Riser Chair was developed by the Israeli firm Tzora Furniture in collaboration with ESHEL, the Association for the Planning and Development of Services for the Aged. The final version looks like an upholstered living room chair and incorporates a piston mechanism, which raises the seat up and forward as the user rises and slows his or her descent on sitting. In order to get up, the user presses a button located at the front of the chair or at the side, which releases the mechanism so that the user rises with the seat until it reaches an angle of 30 degrees. At this point the user must finish standing up unaided. To sit down, he or she must sit squarely on the raised seat and push it down with his or her body until the seat reaches its resting position and the mechanism locks.

The chair is available in two seat heights: 1.44 or 1.61 ft (44 or 49 cm) and two piston strengths (1000 or 1400 N). It can lift people weighing 110 to 242 lb (50–110 kg). The strength of the piston can be adjusted by moving a rod under the seat to one of eight settings. The angle at which the seat rises can be adjusted from 0 to 45 deg. (In our study, the angle was fixed at 30 deg.)

The research was conducted with 33 individuals between 60 and 97 years of age, most (26) of whom were women. Of the participants, 12 were recruited from a sheltered housing project and 21 from a day care center for elderly people with disabili-

ties. Although none needed assistance to move around, the majority (28) used walkers or canes and 23 were limited in one to three activities of daily living: eating, dressing, washing, and using the toilet (10 were independent). The subjects suffer from a variety of ailments that affect their ability to rise and sit: musculoskeletal conditions (14), neuromuscular problems (10), cardiorespiratory conditions (2), obesity (2), and general weakness (5).

The elderly participants also differed in a number of anthropometric characteristics: weight, knee height (distance of the knee from the floor), gait speed, and grip force (see the table below). In sitting on and rising from a control chair (the experimental chair with its piston mechanism locked), 7 subjects had no difficulty, 10 had moderate difficulty, and 16 had severe difficulty. All but one subject were able to communicate easily with the research team, and all agreed voluntarily to participate in the research.

Note that the study population is not a representative sample of elderly people with difficulty rising and sitting, as we did not include people who need assistance to be mobile. Neither did we include elderly people with communication disorders or those suffering from chronic illnesses that affect rising and sitting, such as Parkinson's disease.

Rising and sitting with the help of a specially designed chair requires that the elderly relearn activities they once performed automatically.

The Study Instruments

A number of qualitative and quantitative research instruments were employed. Questionnaires with closed and open questions asked participants to compare the ease of use, comfort, aesthetics, and appropriateness of the control and experimental chairs and to discuss their willingness to use each type of chair.

We observed and analyzed videotapes of the participants using both chairs. Based on our clinical experience and information in the literature, we arrived at the following units of analysis: ease of rising and sitting, smoothness of movement, completeness of movement, safety, learning to operate the chair, suitability of the chair to the user, and suitability of the user to the chair. We examined problems that appeared during rising from and sitting in the control chair and whether there was any change following use of the experimental chair (improvement, deterioration, creation of a new problem, or no change). Ultimately, judgment of participants' performance with each of the chairs was based on consensus among the members of the research team.

Case study analysis, a qualitative technique that, in this case, considers the effect on rising and sitting of all of an individual's characteristics (physical, anthropometric, behav-

ANTHROPOMETRIC CHARACTERISTICS OF THE STUDY PARTICIPANTS (N = 33)

Characteristics	*Range*	*Most Frequent Category*	*No. of Subjects in Most Frequent Category*
Weight (with shoes and clothes)	43–110 kg 95–242 lb	60–80 kg 132–176 lb	20
Knee height (distance of the knee from the floor, with shoes)	43–52 cm 17–20 in	47–52 cm 19–20 in	20
Grip force	7–31 kg 15–68 lb	10–19 kg 22–42 lb	16
Gait speed	10–98 cm/s 4–39 in/s	10–24 cm/s 4–9 in/s	14

ioral), was employed in order to arrive at an in-depth understanding of his or her interaction with the chair. This method of analysis is accepted, particularly when the study population is small and heterogeneous.

We conducted biomechanical analyses of the movement of markers fitted to prominent parts of participants' bodies (knee, hip) using quantifiable kinematic parameters (trajectories, speeds, and acceleration of body segments). The goal of this objective analysis was to validate the findings of the subjective, qualitative one and to determine how much the quantitative data contributed to information we obtained through use of the other tools.

The Study Process

We began by selecting members of the target population of consumers to participate in the study. Screening involved consultation with professionals who work with elderly people on a regular basis. After the candidates agreed to participate, we collected data on their sociodemographic, anthropometric, and functional characteristics and on their reported level of difficulty using regular chairs.

The study was divided into three stages. Stage 1 involved trial use of the control and experimental chairs by 22 participants. First, participants sat in and rose from the experimental chair with its piston mechanism locked (control). Then they saw a demonstration of how the experimental chair worked and were asked to try the chair 5 to 10 times. To the extent necessary, the chair was adjusted for each participant (see "Improving the Experimental Chair" later in this article). Participants' experiences with both chairs were recorded with a video camera. The time between rising and sitting was brief, although it varied among participants. Participants were interviewed after they had tried both chairs.

At the conclusion of this stage, difficulties using the experimental chair were identified. Because experience with the chair was brief, we could not tell at this stage when difficulties were caused by (a) the chair's design or mechanism, (b) a participant's physical limitations, (c) incomplete learning on the part of the participant, or (d) a combination of these factors. Nevertheless, in some cases it was clear that the chair's design contributed to difficulty rising and sitting, and the research team subsequently recommended making a number of improvements. We also recommended extending the learning period and clarifying the instructions for use.

One of the main problems that appeared during the first stage of the study involved the strength or force of the piston.

Stage 2, in which we attempted to answer the questions raised in Stage 1, involved trial use of an improved experimental chair by seven participants who had had difficulty with the chair earlier. This time, they were allotted 45 minutes to try the chair. At the conclusion of this stage, the research team recommended making further changes in the design of the chair. (No further changes were required in the instructions for use.)

Stage 3 involved a trial of the final version of the chair by 11 new participants. At the conclusion of this stage, we made yet another round of changes to increase the chair's effectiveness.

How Consumer Research Contributes to Design

Some problems with the use of the chair were not anticipated by the manufacturer. The research team focused on two aspects of every problem that arose: the suitability of the chair's design to the user and the user's "suitability" or ability to adjust to the chair. The first aspect required a design solution, whereas the second required a learning solution.

One of the main problems that appeared during Stage 1 involved the strength or force of the piston. Using a stronger piston, participants either had difficulty forcing the seat down or were pushed up too forcefully. Using a weaker piston, participants found it easier to force the seat down when sitting but were not helped sufficiently in rising. The following are among the design solutions found for this problem.

Criteria for adjusting piston strength. During Stage 1, the criterion used was that recommended by the manufacturer: the user's weight. However, this was based on data for healthy people. It became clear that additional criteria had to be considered, such as the physical strength of the user and his or her level of disability and use of mobility aids (walker, cane, etc.). We also learned that because some users had greater difficulty pushing the seat down, it was best to adjust piston strength first according to the force of resistance at which

the user could easily push down the seat and then according to the force at which he or she could rise gently. We found that the more confidence a user acquired in learning how to operate the chair, the less force was needed from the piston. This also supports the idea that the process of adjustment is a gradual one.

The force of the piston. During Stage 1, most of the participants used the piston set at 1400 N, which proved to be too forceful for them. During Stages 2 and 3, the manufacturer introduced a weaker piston (1000 N), which seemed to be an improvement for most participants.

Seat height. Inappropriate seat height in the experimental chair compounded the participants' difficulty using the piston mechanism. During Stage 1, the recommended seat height was 1.61 ft, which was too high for some participants. We therefore suggested two heights – 1.44 and 1.61 ft. Implementing this suggestion during Stages 2 and 3 proved successful.

The release button. Before rising from the experimental chair, the user must press the button that releases the piston mechanism. The chair used during Stage 1 had a button at the right front of the seat. Observation of the videotapes revealed that some elderly participants found it difficult to bend forward to push the button. We recommended adding a second button at the side of the chair. This is important to potential users with various disabilities, but it is crucial for elderly people, who may need to use the more easily accessible button if their health deteriorates. The addition of a button on the side of the chair used during Stage 3 proved helpful.

Sitting down and rising are considered automatic behaviors, but sitting in and rising from the experimental chair required a complex learning and adjustment process. To sit, users had to learn to touch the chair seat as soon as they began to sit down and to push it down fully so that the piston mechanism locked. To get up, they had to learn to press the release button and rise with the chair seat until the seat reached its highest position, at which point they could finish rising by themselves.

We discovered that allowing 10 minutes for trial use of the chair during Stage 1 was not enough; elderly participants had insufficient time to adapt to the piston mechanism and learn to push the release button – let alone internalize these actions and make them automatic. We therefore recommended extending the learning period. During Stages 2 and 3, participants were given 45 minutes to try the chair and acquired greater confidence in using it.

It became clear that additional criteria had to be considered, such as the physical strength of the user and his or her level of disability and use of mobility aids.

Improving the Experimental Chair

After reviewing the improvements in the chair's design and obtaining guidance from potential consumers, we wanted to determine if the problems that had arisen in Stage 1 had been solved by Stage 3. Analysis of the videotapes clearly showed that progress had been made: During Stage 1, two of the participants found the piston to be too strong, particularly in pushing them up; no such complaints were made during Stage 3. During Stage 1, 10 participants had difficulty pushing down on the seat; only 3 participants had such difficulty during Stage 3.

Nevertheless, it seems that the Hi-Riser Chair is more helpful with rising than with sitting, according to both participants and members of the research team. At the conclusion of Stage 3, we recommended that the manufacturer examine whether it was possible to make the mechanism equally effective for rising and sitting: for rising, by increasing piston strength when the user starts to rise and reducing it as he or she finishes rising; for sitting, by reducing piston strength as the user starts to sit and reducing it further as he or she finishes sitting.

Our findings indicate that the Hi-Riser Chair can assist elderly people with difficulty rising and sitting who are otherwise independent and mobile – provided that it is adjusted properly and that they receive both skilled instruction and the opportunity to adapt to the chair.

Aspects of a Marketing Strategy

An additional benefit of our research was that it provided a basis for developing a marketing strategy. The findings proved especially helpful in identifying the target population, positioning the product, and customizing the chair for the consumer.

The chair can be used by people with various types of disabilities, on the condition that they find a suitable strategy for

rising. People who have benefited from using the chair include the very obese and those with moderate pain or difficulty moving the back, arms, or legs. The Hi-Riser Chair proved unsuitable for people who are extremely weak or unstable or who suffer from severe pain during movement. (A follow-up study of the first 40 purchasers of the Hi-Riser Chair revealed that the chair is indeed a help to elderly people who are not independent in mobility.)

Others not included in the study, such as people with Parkinson's disease, might be expected to benefit from the Hi-Riser Chair. The chair is also likely to benefit therapists and relatives who care for people with difficulty rising and sitting who are not independent or mobile.

Concerning product positioning, the Hi-Riser Chair – though conceived as an assistive device for rising and sitting – looks like an ordinary easy chair with attractive upholstery and an unobtrusive assistive mechanism. These qualities help to minimize the stigma that is typically associated with assistive devices. Participants reported that the chair was comfortable and easy to use and expressed willingness to use it at home or in a public place. Reactions to the price of the chair were not examined in this study.

Adjusting the chair to suit the user (and to ensure his or her successful adaptation to it) requires the assistance of a professional. The chair can be sold in stores that specialize in assistive devices for people with disabilities or in furniture stores whose sales staff have undergone appropriate training. The chair cannot be sold "off the floor." We prepared a set of guidelines for sales staff on how to adjust the chair, how to instruct the consumer to use it, and the possible dangers of the chair and how to overcome or circumvent them. We also suggested using written material and a videotape presentation to instruct elderly consumers and their families and caregivers.

The Hi-Riser Chair's piston mechanism requires servicing and maintenance. This is particularly important for elderly consumers whose functional ability may deteriorate, necessitating adjustment of the piston mechanism.

Involving potential elderly customers in the development of the Hi-Riser Chair helped to improve the chair's design and to ensure its acceptance. Ultimately, our study was instrumental in developing the version of the chair now being marketed and the strategy being used to appeal to potential consumers.

The findings proved especially helpful in identifying the target population, positioning the product, and customizing the chair for the consumer.

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The authors dedicate this article to the memory of Bernard Isaacs, beloved colleague, friend, and adviser, whose contribution to geriatric studies is immortal.

ג'וינט־מכון ברוקדייל
לגרונטולוגיה והתפתחות אדם וחברה

מתאימים את הכיסא,
מתאימים את המשתמש

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נטע בנטור • אריאל סימקין

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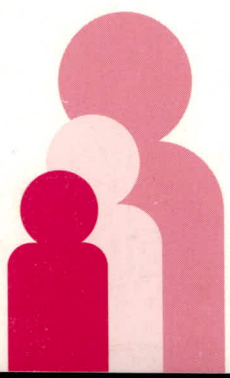

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ג'וינט–מכון ברוקדייל מהו?

מרכז ארצי למחקר בתחומי הזיקנה, התפתחות האדם
ורווחה חברתית בישראל, שהוקם ב–1974.

ארגון עצמאי ללא כוונת רווח, הפועל
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צוות של אנשי מקצוע המקדישים עצמם
למחקר יישומי בסוגיות חברתיות
בעלות קדימות עליונה בסדר היום הלאומי.

קבוצת חשיבה שנטלה על עצמה מחויבות
לסייע לקובעי המדיניות ולספקי השירותים
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מתאימים את הכיסא, מתאימים את המשתמש

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תקציר

כמה פעמים אתה קם מהכיסא במשך היום? ייתכן שאפילו אינך חושב על כך. קשישים ואנשים עם מוגבלויות - במיוחד אלה הסובלים ממחלות כרוניות המשפיעות על חלק גופם התחתון - מתקשים בעת הקימה מהכיסא (Kerr et al. 1991; Wheeler et al. 1985), ועם זאת היכולת לקום מהכיסא חיונית ביותר לעצמאותו של הקשיש. לפי נתוני משרד הבריאות והרווחה בארצות-הברית ב-1991, שמונה אחוזים מכל הקשישים בארצות-הברית התקשו בעת הקימה מהכיסא.

במאמר זה אנו דנים בתרומתו של מחקר צרכנים לפיתוחו של כיסא מיוחד - כיסא-רם - למען קשישים ואנשים מוגבלים. התמקדנו בתשומה של הצרכנים לתהליך עיצובו של הכיסא, לפיתוח הוראות לשימוש בכיסא ולתכנון אסטרטגיית שיווק.