INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED'07
28 - 31 AUGUST 2007, CITE DES SCIENCES ET DE L'INDUSTRIE, PARIS, FRANCE

DESIGN REQUIREMENTS AND THE OLDER ADULT

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ABSTRACT

This paper reports on the findings of an ongoing study investigating design requirements and the older adult. It is well recognised that many products do not meet the requirements of the rapidly growing older adult population. A number of reasons exist for this including a mismatch between the data produced by biomechanical testing and the requirements of the design community. A methodology is described which closes the loop between these disciplines ensuring that designers have relevant and useable data with which they can design for the ageing population. This particular study focuses on the design of everyday consumer packaging. The paper describes, in detail, a survey which clearly identifies the types of packaging that older adults struggle with most together with coping strategies commonly employed. Initial findings of an ongoing 'study of practicing designers' and an 'observational video study' are also presented.

Keywords: older adults, Inclusive Design, consumer packaging, biomechanics, design requirements

1 INTRODUCTION

Biomechanical research is producing valuable data relating to the strength and mobility of the older generation and how they interact with products. However, the design requirements of the older generation are frequently not being met in the design of everyday products. There are thought to be a number of reasons for this including:

- Designers are not aware that the data exists.
- The data is presented in a format that designers find difficult to understand and use.
- Data produced from biomechanical testing does not match the requirements of product designers.

This paper details the findings to date of an on going research programme funded by SPARC (a partnership between EPSRC and BBRC) aimed at addressing these problems. The ultimate aim of this research is to provide designers with complete, accurate, relevant and useable requirement data pertaining to the older generation. This particular study focuses on consumer packaging. It is widely known that the older population commonly have difficulty interacting with everyday consumer packaging. Clearly user requirements of the older population are not being met in the design of consumer packaging.

This aim of this paper is to present an overview of this research and report on the findings to date.

2 BACKGROUND

There are a number of researchers currently addressing elements of the design data issues raised in section 1. Sims [1] carried out a survey of twenty-nine design professionals which showed there was no evidence of them actually using any of the types of data which this particular study focuses on. Whilst they were aware of 'Inclusive Design' a lack of time, resources and client backing were found to be the main reasons for them not using the data. Packaging openability research to date tends to have been highly specific, concentrating mainly on packaging such as jam jars and drinks bottles [2,3].

This work has all been carried out with a view to measuring people's strength. Little work has been completed investigating the combination of biomechanics, posture and dexterity required. Winder et al [4] used a customer survey to investigate which types of packaging caused people most "difficulty". This work however, did not truly explore the nature of the difficulties experienced. Previous work has also been carried out to gather together comprehensive data on older adults; anthropometric, strength, and a description of how cognitive functioning and psychomotor functioning change with age [5]. Steenbekkers and Beijsterveldt [6] also attempted to place 'design guidelines' alongside the raw data, to help the designers interpret and use it correctly. Porter et al [7] have presented the HADRIAN initiative to allow designers to evaluate their designs against a database of 100 individuals, including elderly and disabled subjects, to establish the level of exclusion for a particular design. Although this work provides clear value in terms of assessing accessibility it would be preferable to integrate inclusion criteria from the initiation of the design process.

These diverse research studies highlight that others recognise this as an area requiring attention. Research to date has focussed on addressing only elements of the overall problem

Consumer packaging, the focus of this study, can present a significant barrier to achieving one of the most important basic activities of daily living, namely being able to feed oneself [8]. While the inability to open packaging can contribute towards a loss of complete independence for an older adult, and can occasionally cause injury [9], it is thought that it more frequently causes consumers (both young and old) a varying degree of inconvenience, discomfort and dissatisfaction.

Recent research has investigated the type of person who is likely to complain about packaging being difficult to open, and who is most likely to injure themselves while opening packaging [4]. The results suggested that it is particular personal characteristics and personality traits, as well as left-handedness, that are the strongest predictors of who will struggle and potentially injure themselves when opening packaging. In a direct response to these reported difficulties, other important research has selected a specific type of packaging known to be difficult to open, generated corresponding strength data, and then sought to use a combination of mathematical, computational and uncertainty analyses to provide manufacturers with methods to achieve a more inclusive design [3, 10].

In another response to the difficulties faced by users, manufacturers have produced a variety of assistive tools or devices (AD's) that can make the opening of certain packages easier for users who have difficulties and who have specific impairments. While these do represent a solution to the problem, there have been questions asked of assistive technologies in general, namely their aesthetic design, suggesting that a "clinical appearance" contributes to the social stigma surrounding them [11, 12]. Other research has focussed on the effectiveness of the various packaging AD's available, concluding that most of them are ineffective and do not actually improve user performance [13]. The findings from the research described in this paper will offer some alternative thoughts on this matter.

This study is unique in that it is adopting a holistic approach, allowing the loop to be closed between the data produced and its successful integration into the design process. This will being achieved through harnessing expertise in both biomechanics and the design process.

3 METHODOLOGY

A number of key stages are being followed to meet the project objectives:

- **Package openability survey (complete)** - this survey which focuses on the 60-90 age group identifies which types of packaging are most difficult to open, who finds packaging particularly difficult, how significant a problem is packaging openability, what alternative opening strategies are used, are older adults aware of the various Assistive Devices that are available, who owns Assistive Devices and how do they really feel about them?

- **Study of practicing designers (complete)** - structured interviews are being used to identify

common problems relating to the interpretation and application of biomechanical data within the packaging design community. The results will provide an Insight into designers' knowledge of available biomechanical data and how this data is currently integrated into the product design process.

- **Observational video study (complete)** – This study is being carried out in parallel with the 'Study of Practicing Designers'. Subjects in the 60-90 age range are being studied opening six different types of "difficult to open packaging" identified in the package openability survey as being particularly difficult to open. Subjects are being studied and video recorded opening the packaging using their preferred method, be this with or without assistance using everyday kitchen tools provided i.e. knives, scissors, etc or an Assistive Device. Once completed the subjects' motion patterns will be analysed to provide evidence of any 'coping strategies'.

- **Biomechanical testing (to be completed)**: Subjects observed during the video study will be asked to open the same packaging which will be instrumented to allow measurement of forces. Integration of force and motion data via the Vicon Workstation (Vicon Motion Systems, Oxford, UK) will allow development of methods to analyse kinematics (arm/hand/finger segment position and motion) and kinetics (joint forces and moments) using proprietary Vicon Bodybuilder software**.**

- **Integration in the Design Process (to be completed):** The data obtained from the video study and biomechanical testing will be analysed and manipulated to allow presentation in formats which meet the criteria of the design community identified in the study of practicing designers. Thus closing the loop.

Section 4 provides details of the package openability survey which is complete . Section 5 describes the methods and findings to date of the observational video study and study of practicing designers which are being carried out in parallel and are ongoing.

4 PACKAGE OPENABILITY SURVEY

4.1 Method

A subject group of 38 older adults was used, with a minimum of 5 from each gender in the following age ranges; 60-69, 70-79 and 80+. The final subject group consisted of 23 females and 15 males, with the mean ages of 72.78 (SD = 8.25) and 73.71 (SD = 7.83) respectively. For comparison purposes a control group of young healthy adults was also included; 5 males and 5 females with mean ages of 23.8 (SD = 0.84) and 28 (SD = 2.83) respectively.

The older adult volunteers were recruited from a number of different sources to ensure a sample group with an even spread of socio-economic backgrounds, and who had varying degrees of independent living. All subjects lived without any full-time carer. The sources used were; various lunch clubs, the University of Strathclyde senior studies institute, sheltered housing complexes, and a bowling club, all within the Glasgow area.

4.2 Questionnaire Description

The subjects were asked to participate in a 20 minute face-to-face standardised interview. The standardised interview technique was chosen to ensure higher response rates and to allow the opportunity to correct any misunderstandings that may occur. This technique, although time consuming to conduct and process, also had the advantage of allowing the interviewer to probe the subjects for more detailed responses and to clarify any vague answers they might have given. The interview covered topics including; if they ever need help opening packaging, what 'alternative opening strategies' they might use, if they use any AD's to help open packaging, rate how difficult they find opening different types of packaging, and their attitudes towards packaging design in general. Respondents were also asked if they suffered from any specific hand problems. A series of

show cards, with photographs, were used in conjunction with questions to eliminate any ambiguity regarding packaging types and to show a series of AD's.

In order to test their attitudes towards packaging design, a series of 24 attitude statements were used to establish respondent's feelings on the following six topics:

1. Level of anger/frustration/inconvenience caused by packaging (+ = Annoying)
2. Importance placed on independence, determination to be self-reliant (+ = High level of importance)
3. Packaging designers being inconsiderate of older adults' needs (+ = Inconsiderate)
4. Decline in hand function (+ = Noticeable decline)
5. Packaging could be designed to be easier to open (+ = Yes)
6. Finding packaging small and fiddly (+ = Yes)

Each individual attitude statement was measured using a Likert scale (strongly disagree=1, disagree=2, not sure=3, agree=4, strongly agree=5), although it should be noted that some of these scores had to be reversed when a negative statement was used.

For each respondent a 'total packaging score' was calculated as a measure of how difficult or easy they found it to open packaging in general, using a summation of the Likert ratings they provided for each individual packaging type (very easy=1, easy=2, OK=3, difficult=4, very difficult=5). The range of possible scores was from 16 (no difficulties at all) to 80 (found every type very difficult). A similar system was used to give each respondent an 'alternative score', a measure of how many different alternative strategies they use for packaging opening, and how frequently they use them. This scale ranged from 0 (never use any) to 24 (use all of them frequently). Finally, a Likert scale was used again to measure four AD related attitudes, as listed in figure 3.

In order to establish whether or not a result was statistically significant a number of non-parametric statistical tests were used; binomial distribution, 1-sample sign, Mann-Whitney and chi-square tests. A result was considered to be significant when $p<0.05$.

4.3 Results

The introductory questions of the questionnaire provided some interesting findings. Firstly, everybody in both the subject and control groups reported to having had some difficulty with packaging at some time. 29 of the 38 subject volunteers reported having had to ask someone to help them open packaging, which is statistically significant ($p<0.001$). Importantly, of these 29 subjects, 19 of them ($p<0.05$) have to rely on outside help from neighbours, relatives or the next person to visit, when they are unable to open something themselves.

Table 1: Difficult/Easy Packaging, including gender and 'hand problem' differences

Packaging Type			**Gender**		**Reported Hand Problems**	
Rank	Description	Mean (SD)	**Male** Mean (SD)	**Female** Mean (SD)	**'Yes'** Mean (SD)	**'No'** Mean (SD)
1	Jars	4.03 (0.85) †	3.67 (0.98)	4.26 (0.69) *	3.58 (1.07)	2.95 (1.18)
2	Bleach Bottles	3.97 (0.99) †	3.57 (1.09)	4.22 (0.85) *	3.67 (0.84)	2.79 (1.13) *
3	Soft Drinks Bottles	3.54 (1.12) †	2.93 (1.21)	3.91 (0.90) *	3.05 (0.91)	2.63 (0.83) *
4	CRC Medicines	3.50 (1.13) †	2.73 (0.88)	4.00 (1.00) *	4.16 (0.96)	3.89 (0.74) *
5	Flexible Sealed Bags	3.46 (1.04) †	3.38 (1.19)	3.50 (0.96)	2.32 (0.75)	2.16 (0.76)
6	Shrink Wrapped	3.37 (0.79) †	3.27 (0.80)	3.43 (0.79)	3.61 (0.98)	3.29 (1.10)
7	Tins with Ring Pull	3.26 (1.16)	3.13 (1.13)	3.35 (1.19)	2.95 (1.03)	2.76 (1.03)
8	Drinks Cans	3.25 (1.08)	2.69 (1.11)	3.63 (0.90) *	3.32 (0.67)	3.42 (0.90) *

9	Biscuit Packets	3.22 (1.08)	3.07 (0.96)	3.32 (1.17)	3.21 (0.71)	2.95 (0.91) *
10	Trays with Film	3.08 (0.82)	2.80 (0.86)	3.26 (0.75)	3.89 (0.94)	3.17 (1.20)
11	Cartons	3.06 (0.86)	3.00 (1.00)	3.09 (0.79)	4.37 (0.90)	3.56 (0.92)
12	Milk Bottles	2.92 (0.97)	2.40 (0.83)	3.26 (0.92)	3.89 (1.15)	3.11 (0.99) *
13	Soup Pots	2.86 (1.02)	2.31 (0.95)	3.17 (0.94)	3.11 (0.81)	3.00 (0.94)
14	Normal Tins	2.84 (0.89)	2.60 (0.91)	3.00 (0.85)	3.32 (0.95)	2.53 (0.84)
15	Dessert Pots	2.75 (0.73) ‡	2.64 (0.93)	2.82 (0.59)	3.81 (0.98)	2.69 (0.87)
16	Margarine Tubs	2.24 (0.75) ‡	2.20 (0.86)	2.26 (0.69)	2.94 (0.64)	2.56 (0.78)

* Statistically significant difference with Mann-Whitney test ($p<0.05$)
† Significantly more DIFFICULT with 1-sample sign test ($p<0.05$)
‡ Significantly EASIER with 1-sample sign test ($p<0.05$)

In terms of the most difficult types of packaging to open, the results are ranked in order of difficulty in table 1 above. The rankings were calculated using the means of the Likert ratings given by each respondent in the subject group only.

The table also shows that there are six packaging types that are significantly more difficult that the others, and two that are significantly easier. Both the difficult and easy types of packaging are highlighted in grey. The table also highlights any significant differences in results between the sexes, and furthermore between those who did and did not report any specific hand problems.

From the same set of results a packaging score, as described previously, was calculated for each respondent. While age proved not to be a significant predictor of packaging score within the subject group, gender certainly was, with males and females having mean scores of 45.7 (SD = 9.3) and 53.48 (SD = 6.19) respectively. The two groups are significantly different ($p<0.01$), so for the subject group women report more difficulties opening packaging than men. The control group also had a significantly lower overall packaging score than the subject group, with a median of 32.5 compared to 50 ($p<0.0001$), so older adults report more difficulties opening packaging than young healthy adults.

The next section of the questionnaire asked the subjects about which alternative strategies they might employ when they are having difficulty opening packaging. The most commonly used strategies are displayed below in figure 1a. It was also the case that the older adults in the subject group were significantly more likely to use alternative strategies more frequently than the control group ($p<0.01$), as shown in figure 1b. Again, every respondent reported using some alternative strategy to get into packaging at some point or another.

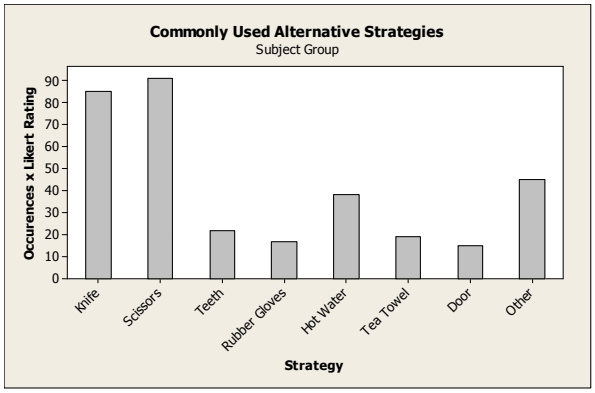

Figure 1a: Alternative Strategies

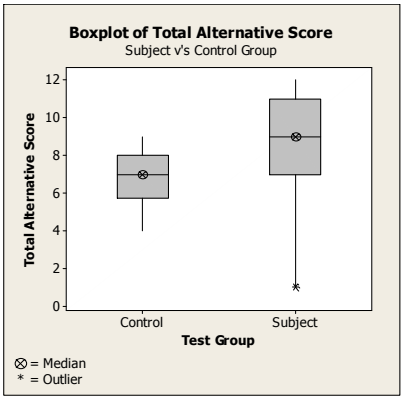

Figure 1b: Total Alternative Score

A comparison of the attitudes held by the subject and control groups is shown in figure 2, demonstrating that the respondents in the subject group generally reported positive scores for all of the attitudes tested apart from attitude 1 (refer to 'Methods' for full description of attitudes tested).

There were significant differences between the attitude levels of the subject and control groups for attitudes 1, 4 and 6 ($p<0.05$; $p<0.001$; $p<0.001$ respectively). There were also significant gender differences for the same three attitudes within the subject group, with females reporting more positive responses ($p<0.05$; $p<0.01$; $p<0.001$ respectively).

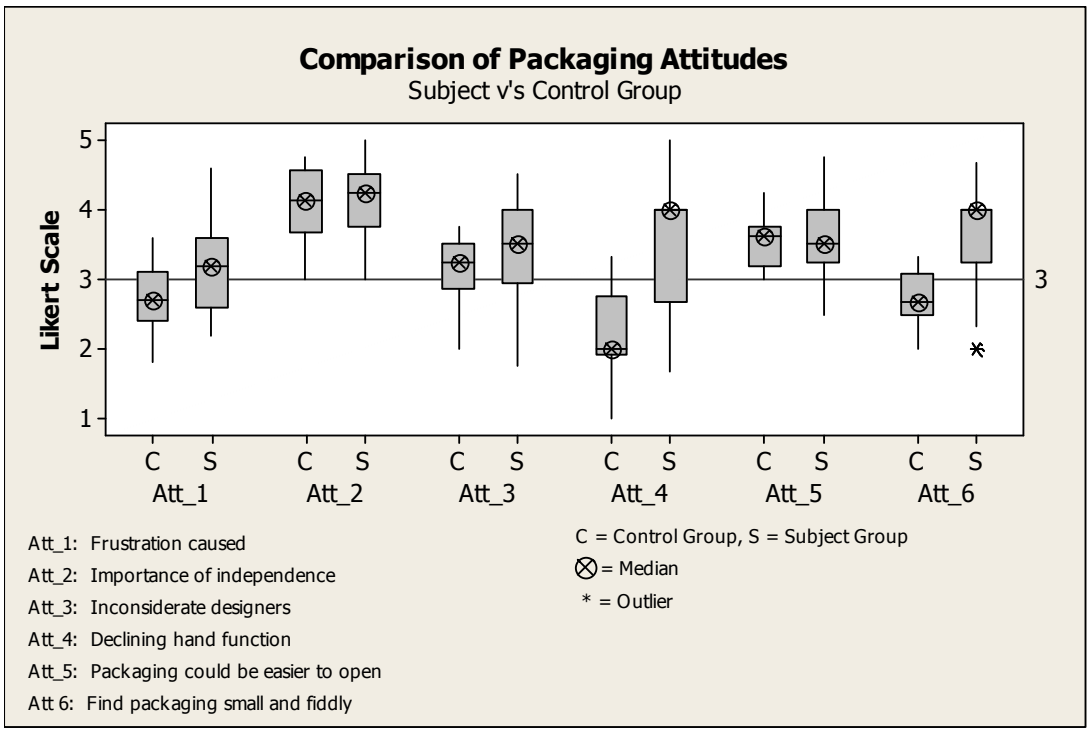

Figure 2: Packaging Attitudes

Respondents were asked a number of questions about assistive tools and devices, mainly whether they owned any, and their attitudes towards them. The results showed that it is predominantly women who own assistive devices ($p=0.018$). The subject group's responses to the four attitude statements are shown adjacent in figure 3.

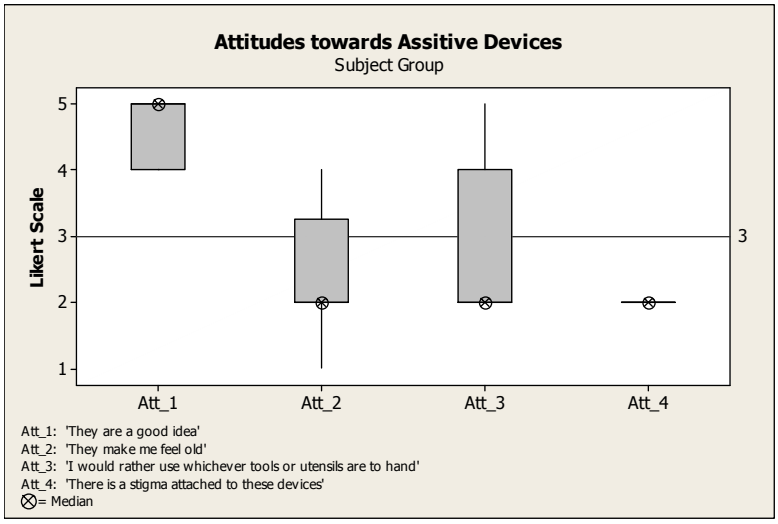

Figure 3: Assistive Device Attitudes

The only significant gender differences were for question 2, with females being more likely to agree with the statement "they make me feel old" ($p<0.05$). When comparing the responses of the subject and control groups there was just one significant difference in attitude, for question 3. The younger control group reported that they would "rather use which

ever tools or utensils are to hand" rather than the assistive devices ($p<0.001$). When the results of statements 1, 2 and 4 were pooled together to give each respondent an overall positive/negative attitude score, the results showed that the control group had a less positive attitude towards assistive devices ($p<0.05$) although it was positive overall.

An important result from the analysis of assistive device ownership was that it was not directly related to specific hand problems ($p>0.1$), so there are a number of older adults with hand problems that do not use these devices, and similarly there are a number who have no hand problems that do use them.

4.4. Discussion of Packaging Openability Survey

The results of the questionnaire provided a number of both interesting and unexpected findings, many of which are important to both the packaging industry and the inclusive design community.

According to these results, the most difficult types of packaging predominantly seem to be those which involve the application of some torque through a twisting motion of the fingers and wrist. As highlighted in table 1 these packaging types include jars, bleach bottles, soft drinks bottles and child resistant closure (CRC) medicine bottles. While previous studies have generated similar results [4] what was particularly apparent here was that it is principally female older adults who report more difficulty with opening packaging across all varieties, although the differences are more pronounced for those requiring the application of torque. Given the prevalence of arthritis in females compared with males; 2.7:1 for rheumatoid arthritis [14] and 2:1 [15] for osteoarthritis, the reported difficulties are not surprising. This study agreed, with the results showing that hand problems were more common for the women within the subject group ($p<0.05$). It is interesting that the packaging types considered to be the most difficult to open mainly relied on strength, whereas other types of packaging that relied more on dexterity and fine touch were described as being 'fiddly' or 'annoying' but not necessarily difficult.

The least difficult types of packaging, as highlighted in table 1, appear to be those which require only a small amount of force to be exerted by the user such as dessert pots and margarine tubs. These are characterised by the presence of a relatively stable base with a film on top which can be peeled off using a basic pinch grip, with no twisting action required. It is interesting that milk bottles (which do require a twisting action) were considered to be relatively easy to open, ranked in 12th position. It is thought that this is because when compared with the other packaging types that require a twisting motion, the torque required to open milk bottles is smaller.

In terms of the alternative strategies, every respondent reported using knives and scissors to open plastic packaging at some time or other, so although this is thought to be rather dangerous [9], it can be regarded as commonplace. While there was nothing particularly remarkable about the alternative strategies listed in the questionnaire, some of the 'other' strategies mentioned were of interest mainly due to the higher levels of danger involved. Jars were most commonly involved with these strategies, with screwdrivers, teaspoons, worktops, kitchen knives and even tin openers being utilised to release their lids. One respondent reported using a claw hammer to open a can of beer, and another carried a swiss army knife in preparation for any unforeseen packaging problems that may occur during the day. It is important to appreciate that these are some of the desperate measures that certain older adults will resort to when they become exacerbated. It becomes even more important considering the fact that most people who need help with packaging live alone, so will be forced to choose between using an alternative strategy, and being greatly inconvenienced by having to wait for someone to help them.

The attitude statements provided results such that the following generalisations can be drawn about the subject group:

- They consider their independence to be of great importance
- They consider packaging designers to be inconsiderate towards their needs
- They have noticed a recent decline in their hand function
- They believe packaging could be designed to be easier to open

• They find packaging to be generally ‘quite fiddly’

Few of these results were strong enough such that they could be described as anything more than a disgruntled or dissatisfied attitude towards packaging. Some of the respondents commented that they appreciated the package’s primary function is to protect its contents, and that making a package easier to open may compromise this. Furthermore, there was also a notable acceptance amongst the subject group that they will struggle with certain tasks as they get older, suggesting that they should be receptive to the idea of AD’s.

It transpired that it is mainly women who own AD’s which is understandable given that they generally find package-opening more difficult than men, and are more likely to report specific hand problems. Although the subject group reported a generally positive attitude towards AD’s, further analysis showed that the people who actually owned them were more likely to say that they made them feel old. This implies that although older adults are generally receptive to the concept of AD’s, their attitudes change when they actually have to use them. It was noted during the interviews that a number of respondents, particularly men, adopted an almost disdainful attitude, commenting that “they’re a good idea – for those who might need them” or words to that effect. It was initially assumed that AD ownership would be directly related to specific hand problems, such as arthritis, however this was certainly not the case as mentioned in the previous section. The group who suffer from hand problems but did not own or use AD’s all reported that they were aware of them being available, and none of them reported particularly negative attitudes towards them. It could be postulated that this group is exceptionally self reliant, or that they do not know where to purchase these devices. The opposite group (who reported no specific hand problems but own AD’s) will most likely be using them for convenience sake, and have no worries about how others may perceive them using these devices. One final interesting result related to AD’s is the difference in attitudes towards them between the subject group and the control group. While the control group did have a positive attitude towards AD’s, it was not as strong as that of the subject group, and they also reported that they would be much more likely to use standard kitchen utensils to open something, rather than an AD. This suggests that much of the supposed stigma surrounding these devices is only really apparent in the younger generations, whereas older adults mostly accept the fact that a decline in hand function is imminent, and they do not mind using these devices.

An important observation made during the analysis of the results was the distinct lack of statistically significant age related differences between the three sub groups of the subjects studied. It had been hypothesised that the oldest members of the subject population would report more difficulty than their younger counterparts, given the expected loss of strength they will likely have experienced [5, 6]. One explanation for this is that the individual differences between older adults are most apparent in the physical functioning of the oldest older adults, so researchers are likely to find a high level of variation when testing with these groups. Given this high level of variation in individual physical ability designers will find it difficult to design for any specific age group. Furthermore a large number of research studies have proven that chronological age is not an accurate predictor of function or performance [16], so designers should remain focussed on specific ability data.

5 OBSERVATIONAL VIDEO STUDY AND STUDY OF PRACTICING DESIGNERS

5.1 Observational Video Study – Background and Method

During this study a total of 40 adult subjects were studied opening six different types of packaging identified as being “difficult to open” from the packaging openability survey. Specifically:

- Jars (tesco value pasta sauce, 440g)
- Soft drinks bottle (irn-bru, 500ml)
- Soft drinks can (irn-bru, 330ml)
- Tin with ring pull (Heinz vegetable soup, 400g)

- Child Resistant Medicine Bottle
- Bleach bottle (original Domestos, 750ml)

Subjects are grouped into four age groups equally balanced in gender, these being a control group aged between 20-35 and three groups of older adults aged 60-70, 70-80 and 80+. Individually, subjects were studied and video recorded opening each of the different types of packaging using their preferred method. If appropriate subjects could open the packaging with the help of everyday kitchen tools provided i.e. knives, scissors, tea towel etc to replicate everyday practice within the home environment. Subjects were also given the option of using an Assistive Device if they regularly employ one in their home. Figure 4 shows the laboratory set up for the video study showing a dimensional replica of a standard kitchen worktop with typical kitchen implements provided and camera positions.

Figure 4 Laboratory set up for the Observational Video Study

Capturing video is allowing the most difficult types of packaging to be identified together with their most typical opening strategies and motion patterns. This study is also providing an insight in to 'coping strategies'. Figure 5 shows the views that are captured by the cameras.

Figure 5 Views Captured by the Camera's

5.2 Observational Video Study – Findings

The Observational Video Study revealed that jars are the most difficult type of packaging to open which backs up the findings of the package openability survey. Only 37 subjects attempted to open the jar with their bare hands (3 subjects said they would always use an assistive device instead). 9 out of the 37 failed to open the jar at all. Of the 28 who managed to open the jar with their bare hands, 9 of

them required more than one attempt to open it an attempt being classified as a force clearly being exerted on the lid.
There were 2 main strategies used by both the subject and the control groups. These two strategies were determined by whether the left or right hand was used to grip the lid. The most common strategy was to place the right hand on the lid (30 out of 37 subjects). The 7 subjects who used their left hand on the lid were all naturally right handed, reported lower levels of difficulty (NOT statistically significant) and were more likely to succeed in opening (significant with p=0.036).

The following table gives a description of the characteristics of the starting positions and subsequent motions involved in each strategy

		RIGHT hand on lid (n=30)	LEFT hand on lid (n=7)
START POSITION			
	Right Wrist	Ulna Deviated Extended	Flexed
	Right Elbow	Varied	≥90° Flexion
	Right Shoulder	Abducted Internally Rotated Flexed	Internally Rotated Abduction
	Left Wrist	Extended Radially Deviated Neutral	Extended Radiallly Deviated
	Left Elbow	Varied	≥90° Flexion
	Left Shoulder	Internally rotated Abducted	Flexed Abducted Internally Rotated
MOTION	Right Wrist	Radial Deviation Extension	Extension
	Right Elbow	Flexion	Extension
	Right Shoulder	Abduction Internal rotation	Adduction External rotation
	Left Wrist	Flexion	Ulna Deviation
	Left Elbow	No Movement Flexion	No Movement Extension
	Left Shoulder	Internal Rotation Abduction	Adduction Extension

Table 2: Typical Starting Positions and Subsequent Motion Adopted in Jar Opening

General findings from the observational video study can be summarised as:

- Very few subjects are choosing to use Assistive Devices. When they do, it doesn't seem to make the task any less difficult, or speed it up much, but it does usually reduce the amount of pain or discomfort experienced. Those using Assistive Devices do not seem to do so with a particularly high level of control.

- The control group did report some high levels of difficulty, as well as pain and discomfort.

- Difficulty ratings are generally consistent with the package openability study with jars having the highest difficulty ratings and requiring the highest number of alternative strategies.

- No obvious differences between age groups have been identified so far however a significant percentage of the subjects that remain to be tested belong to the oldest age groups.

- During gripping subjects are not using their fingers in isolation, they quite often use their palm as well.

- Subjects and control group members quite often press the packaging down onto the work surface to provide them with extra grip.

- Subjects and control group members often use a cup-shaped hand over the tops of bottles and jars, grasping 2, 3 or 4 fingers together at once.

- When a subject is right handed they will not necessarily use their right hand to grasp the lid of the packaging and support the base with their left. This is the case for both the subject and control groups.

5.3 Study of Practicing Designers

This study took the form of a structured interview within the packaging design industry. Ten companies involved in packaging design are participating in this study ranging in size and product area, thus providing a cross section of the packaging community. Participating companies include Unilever, 4CDesign, Seymour Powell and Field Packaging. The structured interview itself investigates key issues including the companies' current design practice and processes; where 'openability' ranks in importance amongst their design criteria; awareness of what bio-mechanical data exists; how it is currently used if at all?; is it being used correctly ?; what additional data would be useful ?; how best could it be presented? Findings from the ten participating companies can be summarised as follows:

- 'Openability' is not a major concern amongst the packaging designers interviewed when asked to rank a number of design criteria in order of importance 'openability' was not amongst the top 3. Following discussion it became apparent that is not a requirement of the companies or their clients to make the packaging 'easy-to-open' ultimately this would be the decision of the individual designer. Designers interviewed felt that if they designed difficult to open packaging this would be noticed early on through user groups.

- Packaging "appearance" consistently ranked top, designers generally believed that addressing openability issues would have an adverse effect on other 'important' design criteria

- Packaging designers know what inclusive design is with 90% confidently offering an accurate definition. However, they have little or no knowledge of how to put it in to practice with very few having any experience of actually designing products inclusively. Some of the designers interviewed felt they intuitively designed products to be inclusive however, there was little tangible evidence of this occurring. One company commented that they would start adopting inclusive design techniques if their clients demanded it.

- Most of the designers interviewed felt they included older adults in their design process through consumer testing or informal discussion.

- There is very little evidence of ergonomic data being used by packaging designers with only one of the ten companies regularly using it. Most felt this data was too generic and would rarely be suitable for their specific requirements. The preferred approach was to design then test and products using end users through the adoption of user trials, focus groups, observation and ethnography. None of the designers interviewed were encouraged by their management or clients to use ergonomic data

- All designers interviewed had an awareness of biomechanics but only one could offer an accurate definition. Very few knew where they could access biomechanical data.

- Companies interviewed adopt user trials and focus groups, however, these do not always include older adults. Examples of practice include a small design consultancy who regularly use a small, informal group comprising mainly of relatives and their friends through to a large international manufacturer on one occasion employed focus group of older adults, this was considered to be a one off as they do not consider older adults to be in their target market.

6 FUTURE WORK

The Biomechanical Testing stage will commence shortly. The results of the observational video study will ensure that the test rig is designed in a manner that allows the data required by designers to be captured fully. Once biomechanical testing is complete findings of all project stages will then be collated resulting in the integration of the biomechanical data produced within the design process. Thus fully closing the loop that currently exists between biomechanical testing and product design and ensuring that packaging can be opened by all ! Furthermore, it is planned to extend this work to other areas of design relevant to the older adult.

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