Warning! : packaging can damage your health

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Warning! Packaging Can Damage Your Health

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Abstract

Previous work by the authors has shown that access to packaging in hospitals can influence the nutritional status of patients. This work indicated that five particular pack forms performed badly and that the issue surrounding poor access was both linked to strength and dexterity.

The study presented here looks at initial work undertaken to examine the dexterity needed to access these problematic packaging and examine methods for measuring users dexterity. To that end a Purdue Pegboard, questionnaires, HSV and task analysis were used.

This work showed that there was a direct link between the reduction in dexterity and the time taken to open a pack. Further, packs that required multiple stages and complex actions were more likely to be ranked as problematic and cause problems for patients and staff.

Significantly, even users with poor dexterity were however, able to open the packs. This is consistent with work undertaken by Sangar (2011) that showed users who had very poor dexterity and who had their medication decanted could with some effort open their medication. This leads to the conclusion that inability to open the packs is a function of the dexterity, time taken and motivation. In a hospital setting the 'wellness' and posture of the patient may affect dexterity and hence increase time. The degree of 'wellness' is also likely to contribute to reduced motivation.

Keywords: Packaging, openability, nutrition

Introduction

Society is ageing; in 1950 the population of over 65's Worldwide was estimated at 200 million, increasing to 486 million by 2006 and to over 1.5 billion by 2050 (UN, 2008). Natural ageing results in a loss of strength, dexterity and cognition whilst the likelihood of living with some form of chronic illness is significant. The prevalence of disability from the US Census in 2005 demonstrates that for individuals over 75, the proportion of people who need assistance is 55.9% rising to 71% for those 80 and over (US Census Bureau, 2010).

This significant demographic change creates a major public health problem for government, health practitioners and other stakeholders. Further, many of the illnesses previously associated with old age have more recently been attributed to poor diets (Sharkey, 2008).

The significance of these observations becomes clear with the recognition that nutritional status influences the age-related rate of functional decline in some organ systems. Hence there is undisputed evidence that diet and nutrition are directly linked to many of the chronic diseases afflicting older adults (Committee on Diet and Health, Food and Nutrition Board, Commission on Life Sciences, National Research Council, 1989).

A consumer's contact with food occurs across a wide range of scenario's from meals in canteens, restaurants and takeaways to cooking at home with family or friends. Work by Yoxall (2012) showed that as people age, this interaction with food becomes more complex. Factors such as weight of packaging, accessibility of packaging, familiarity of brand and the environment such as isolation, the weather or access to transport effected purchase decisions (see Figure 1). The packaging of the food was seen to play a prominent role in older people's purchase decisions and their ability to access and prepare their food.

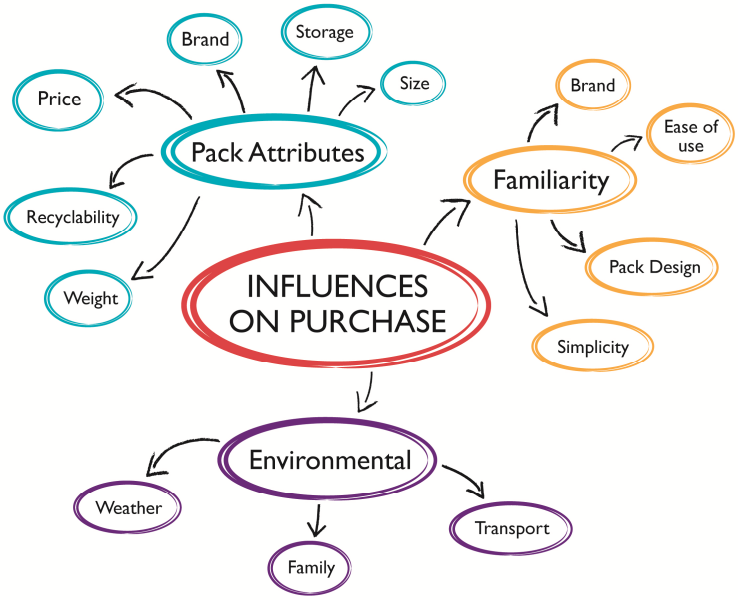

Figure 1: Influences on purchase of older consumers over 70 years old (Yoxall, 2012)

Packaging accessibility, whether for food, medicines or other products, has been found to cause difficulties for the aged or disabled consumer. A survey of 2000 people over the age of 50 by 'Yours' magazine (McConnell, 2004, Figure2) found that 91% of respondents have had to ask for help in opening a package, whilst 71% of respondents had injured themselves trying to open packaging. The 'openability' of packaging is therefore a huge issue for the aged and those with disabilities.

Figure 2: 'Yours' magazine survey

Previous Research

A signifiacnt amount of work has been undertaken by numerous researchers to undertsand the issues surounding packaging and use by older people including the study by Rholes et al. (1983), The Department of Trade and Industry (1999), Voorbij and Steenbekkers (2002) and more recently by Su et al. (2009) and Kuo et al. (2009). The majority of this work has been in attempting to understand the accessibility of glass jars with a vacuum lug closure. This type of packaging is commonly used for sauces, preserves and pickles and in the survey outlined earlier (McConnell, 2004) ranked jars after bleach bottles as the second most difficult item to open.

However, whilst this previous work studied accessibility of packaging amongst the 'well-elderly' less research has been undertaken on the use of packaging within hospitals and care environments.

Schenker (2003) in their review paper estimated 40% of UK hospital patients were malnourished with 60% of patients at risk, whilst further studies have shown that elderly patients are five times more likely to be at risk of malnutrition than younger patients (Lazarus & Hamlyn, 2005; Banks, Ash, Bauer, & Gaskill, 2007; Vivanti et al., 2008).

Significantly work by Mathews, Bartlett, & Hall, (2007) conducted a 1-day malnutrition prevalence audit across hospital sites in NSW, Australia and showed 51% (n = 777) to have some degree of malnutrition and highlighted the difficulty experienced by some patients in opening food and beverage packaging with a number of these patients indicating that they did not eat the food because they could not open it. Further, a series of researchers, have also identified inability to access food and beverage packaging as a contributing factor to malnutrition among the elderly and disabled in hospitals notably,Schenker, (2003) and Walton, Williams, and Tapsell (2006) and Tsang (2008).

Work by Bell et al., (2013) looked at the issue of packaging accessibility in hospitals in the NSW region of Australia. This work used a patient and staff questionnaire along with pinch and grip strength measurments to assess reasons surrounding inability to access food and beverage products in the hospital environment. A typical meal tray with packaged items is shown in the Figure 3 below.

Figure 3: Typical meal tray in the study by Bell et al., (2013)

Over 140 participants under took the packaging questionnaire along with approximately 60 staff. The mean age of the sample was 72 years (±15 years); 46% male and 54% female. The patient interviews in this section of the study identified five forms of packaging that could not be opened: 23% could not open convenience dinners, 17% water bottles, 17% cereal, 12% tetra packages and 10% condiments (jam).

Of those patients who could open the products, approximately 50% of patients had some difficulty opening the convenience meal and the cereal pack. Nearly 40% of these patients also had difficulty opening the water bottle and tetra packs. All staff reported that patients ask for help opening food and beverage packaging and 39% of staff reported some difficulty opening certain

food and beverage packaging items themselves. Figure 4 below shows that items that partcipants were unable to open were also those items that took the longest time to open (where there could be openened). The worst performing items are outlined with arrows indicting the problematic items. The work showed that for water bottles the accessibility issue was related to strength, whereas for the cereal packages and tatra packs the issue appeared to be a problem of both dexterity and strength.

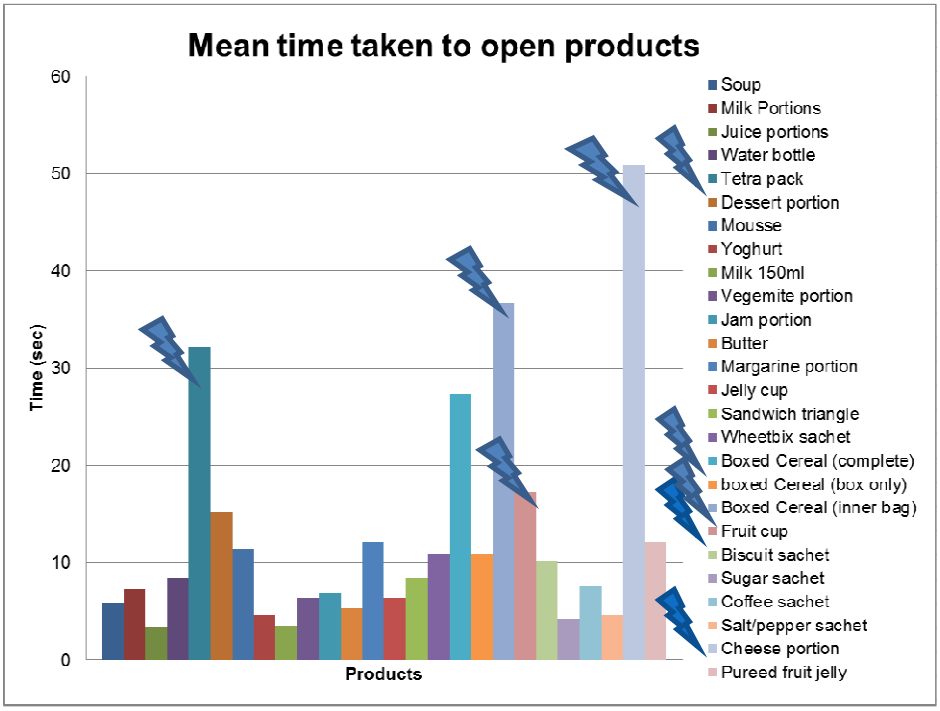

Figure 4: Time taken to open packaging items

New Study

Dexterity Testing

Hence, it was proposed to studying the issue surrounding what patients and staff had termed 'fiddly' packaging by analysing the issue around accessing these problematic items in more detail. Several approaches to this work were undertaken, most notably studying the relationship between packging use and dexterity.

Dexterity of participants was analysed using the Purdue Pegboard Test first proposed by Tiffin in 1948 (Tiffin et al.,). The Purdue Pegboard Test can be used for numerous purposes including testing for the presence and/or extent of brain damage, learning disabilities and dyslexia. There are four individual tests that are carried out when using the Purdue Pegboard. For all of these tests, the participant sits at a table that is at comfortable height (see Figure 5).

Figure 5: Participant undergoing Perdue Pegboard test

Test One (Dominant Hand): The first test involves the participant using their dominant hand to pick up a pin from the cup that is on the same side as the hand that is being used. The pin is then placed in the topmost hole that is also on the same side. This action is repeated and the pin is placed in the next hole down. The aim is to see how many pins the participant can place in thirty seconds.

Test Two (Non-Dominant Hand): The second test is similar to the first, except the task is performed with the non-dominant hand. The participant takes the pins from the cup on their non-dominant side and places the pins down this side as well.

Test Three (Both Hands): The third test involves a repeat of the previous two tests; however, both hands are working simultaneously. In this test, only the number of pairs of pins is recorded.

The sum of these three tests, Right + Left + Both (R+L+B), gives the overall Macro dexterity score for the participant.

Assembly Test: The final test performed is the assembly test. The assembly test involves picking a pin up from the dominant hand side of the board and then placing it in the hole at the top of the dominant hand side of the board. Meanwhile, the other hand picks up a washer and places it over the pin the dominant hand has just placed. After placing the pin, the dominant hand picks up a collar and places this on the same pin so that the collar rests on top of the washer. The dominant hand now places a collar on top of this washer, followed by another washer placed by the non-dominant hand. The final assembly consists of a pin running through the centre of a washer, collar and another washer. This process is repeated down the dominant hand side of the board. The time limit for this test is one minute and the score is determined by the number of individual components the participant is able to place in that time. This score gives the participant's Micro dexterity score.

Hence, 31 participants were asked to open 3 of the five problematic packaging types and the time to open and the dexterity of each participant measured. The water bottle was excluded as the previous

research had shown that inability to access this pack type was mainly due to insufficient grip strength. The milk carton was chosen as it was easily available and had a similar opening tab to the cheese and jam portions. Participants were chosen across the age spectrum with the oldest being 83 and the youngest 19 years of age with the mean age of all participants was 40 years. This enabled the researchers to study the differences between older and younger participants.

Video Analyses

Video Observation

Video ethnography is the video recording of subjects performing actions in their natural setting, in order to gain an understanding of a certain cultural phenomenon of interest. Other research has suggested that more natural settings are needed for studies exploring these areas; rather than solely using lab experiments that over simplify what is being tested. As this is the case, video ethnography, which monitors subjects performing a task in their natural setting, could prove to be a method of expanding these experimental paradigms. The participants were asked to open two of each of the three types of packaging. They were asked to open two of each in order to help eliminate the cognition element of opening packaging. A series of studies were undertaken including interviewing people with their experiences in using the problematic packaging including dexterity analysis and video testing.

High Speed Video Analysis

Participants were also analysed using High Speed Video (HSV) analyses to study finger motion in greater detail. This analyses is able to film at speeds significantly higher than a standard video camera (60 thousand frames a second, a standard camera films at 25 frames per second) using a 'Phantom' SA3 camera (Photron.com). Five participants with low dexterity scores were selected from the previous analyses and their hands filmed both undertaking the Purdue Pegboard test and the subsequent video analysed. Analyses were undertaken at a range of speeds from 60 frames per second (fps) to 200fps.

Figure 6: High speed video analysis

Figure 7: Still frame from HSV of participant opening problematic packaging

Timing

Each participant was timed from the video recordings outlined earlier. This was done so that the timings could be repeated if there was doubt as to when to start the timing. The ability to do this is one of the key advantages of using video ethnography as identified by Joseph Schaeffer.

Each participant opened two of each type of packaging and the fastest time taken was the time used in further analysis. The fastest time was used, as opposed to an average time, because the first attempt to open the packaging was meant to remove the cognition element of accessing packaging. This effectively gave the participants a practice run at opening the packaging to remove learning effects.

Task Analysis

The three types of packaging were segmented into tasks based on the participants' actions and different objectives that must be achieved for the packaging to be opened. Each task consisted of a few actions made by the participant which achieved the objectives. For example, the Cereal Box requires the outer cardboard box to be opened (task one) and then the inner plastic bag to be opened (task two). Each of these tasks is composed of smaller actions made by the participant. Where the tasks for each object usually remain the same for all participants, the smaller, detailed actions that allow each participant to complete these tasks can often change.

The Task Analysis was performed in order to determine if a link exists between the numbers of tasks, or the type of actions required to complete a task, and dexterity. Where participants struggled with the packaging was also noted in this part of the analysis. Where participants found difficulties are the areas that receive design suggestion for improvements.

Results and Discussion

Significant analysis was undertaken as to the most relevant way to show the dexterity results. It was found for example that dexterity change is very sensitive to age, a result consistent with that found by other researchers (Michimata, 2008). No significant difference was found in younger (under 60 year old) participants but significant decline (also matching that of other researchers) was found for the over 60 participants.

Using the HSV analysis and studying the high-definition images produced it was seen that accessibility of the packaging was likely be related to macro-dexterity due to the significant amount of wrist, arm and finger pinch gripping used during accessing these items. It was also shown that accessing the tetra pack and cereal box participants had to undertake a far more tasks and even multiple tasks to successfully access the contents than the milk carton.

It was decided that the most appropriate way of showing the results was by plotting Macro dexterity vs time for the cereal , juice and milk cartons (a technique first published by Rowson et al, 2013). This enables us to assess the influence of dexterity upon the pack performance. A pack un-influenced by dexterity will produce a horizontal line, a pack with a strong correlation to dexterity will have a steeper gradient.

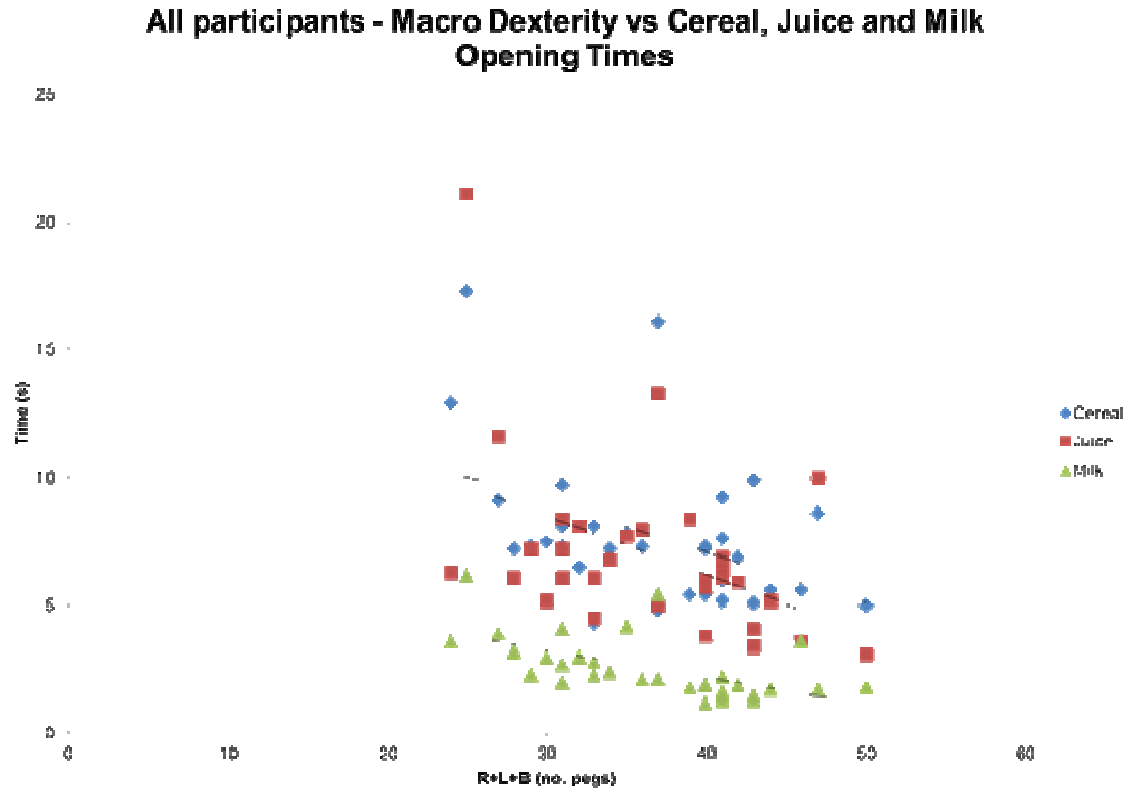

Figure 8: Dexterity versus time for three problematic packaging types

The milk carton was found to be the least susceptible to dexterity, this is largely due to the simplicity of the task when compared to the other items that require multiple tasks and significant dexterity as seen from the HSV analysis.

In our study all the participants were able to access the packs. This indicates there may be issues around 'context of use' between the study conducted here and users experiences in hospitals. For example hospital patients may be in a different posture when using the packaging.

Further, and most of obviously, the user is unwell and in hospital, it is likely that energy and motivation levels will be reduced when compared to the 'well elderly'. Further work is needed to study these differences along with a more detailed analysis on the dexterity.

Conclusions

In the original study by the authors emphasis was placed on the strength needed to access problematic packaging and identify what that problematic packaging was. It showed that there were five packages with the main problem being what participants termed 'fidliness'. In this subsequent work we have looked at a way of identifying what this 'fidliness' might be by examining ways of understanding dexterity and packaging. To that end a Purdue Pegboard, questionnaires, HSV and task analysis were used.

This work showed that there was a direct link between the reduction in dexterity and the time taken to open a pack. Further, packs that required multiple stages and complex actions were more likley to be ranked as problematic and cause problems for patients and staff.

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Future Work

Future work is to examine the effects of posture on dexterity and determine effective and reliable methods to analyse people in in context. It is also desirable to understand the similarities and differences between the packaging used in NSW, Australia and that in used with the UK and elsewhere.

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