User-centred design in robotics and VR

Professor Ray Jones

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with contributions from

Drs Hannah Bradwell, Leonie Cooper, Rory Baxter,

Oksana Hagen, Marius Varga, Mriganka Biswas, Marta Romeo

ComputationWorld 2025
April 6-10 2025, Valencia

University of Plymouth Centre
for Health Technology >>>>

A patient held record and new methods of long term care for patients with diabetes mellitus (1980)

A Computer-Assisted Register and Information-System for Diabetes (1983)

Patient on-line access to medical records in general practice (1992)

Use of a community-based touch-screen public-access health information system (1993)

An on-line explanation of the medical record to patients via an artificial intelligence approach (1995)

Randomised trial of personalised computer based information for cancer patients (1999)

Randomised trial of personalised computer based information for patients with schizophrenia (2001)

Effect of different forms of information produced for cancer patients on their use of the information, social support, and anxiety: randomised trial (2006)

Patient-led learning for the clinical professions in fulfilling the information needs of patients (2000)

Feasibility of combining e-health for patients with e-learning for students using synchronous technologies (2006)

The Diabetes App Challenge: User-led development and piloting of Internet applications enabling young people with diabetes to set the focus for their diabetes consultations (2014)

Examples from 2017 onwards

- 2017 (aged >65)
- Reminiscences of a rather old (now) semi-retired researcher trying to age healthily and support the **next generation** of researchers

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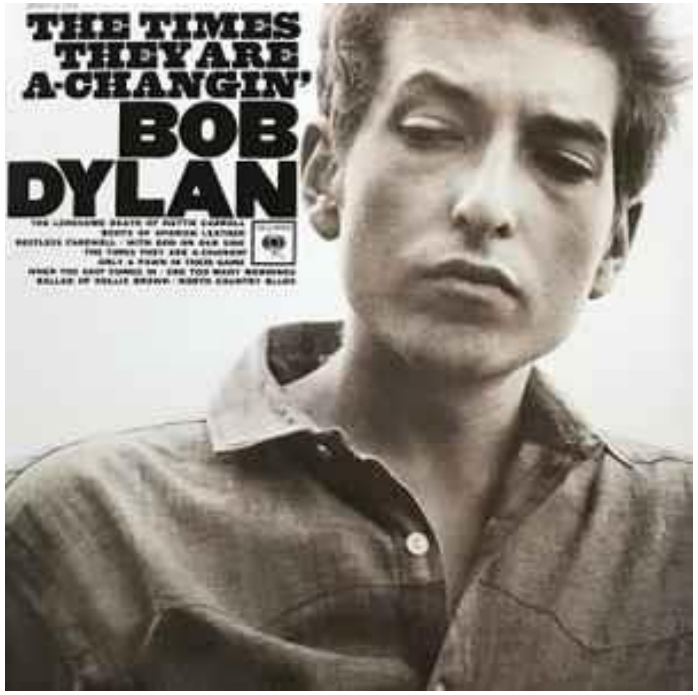


Please get out of the new one, If you can't lend your hand

For the times they are a-changin'

Examples from 2017

- EPIC (ERDF) (2017-2023)
  - Hannah Bradwell's PhD on robo-pets (within EPIC project)
- MOVECARE (EU) (2017-2020)
  - Marta Romeo and Mriganka Biswas multimedia interfaces on robots
- GOALD (ESRC) (2020-2023)
  - Leonie Cooper and Hannah Bradwell on ROVR codesign
- ICONIC (EPSRC) (2022-2025)
  - Recruiting and running intergenerational codesign from Rory Baxter
  - Virtual Reality interfaces from Marius Varga
  - Voice AI from Oksana Hagen

Hannah Bradwell

Find her on
Google Scholar

Loads of papers (2020-2021) on user centred design of robots including.....

- Design recommendations for socially assistive robots for health and social care .....
- Longitudinal diary data: Six months real-world implementation of affordable companion robots....
- Implementing affordable socially assistive pet robots in care homes ... Stratified cluster randomized controlled trial.....
- User-centered design of companion robot pets....

THE Sun
NEWS WEBSITE OF THE YEAR

Is Paro's fate sealed?

Roboticists like the £5000 Paro but older people prefer an £80 cat, says Plymouth researcher.

Younger roboticists preferred Paro and ‘mythical’ robots with more sophisticated features. Older people liked the familiar cats and dogs.

BMJ Open

Latest content Archive For author

Geriatric medicine
Original research

Companion robots for older people: importance of user-centred design demonstrated through observations and focus groups comparing preferences of older people and roboticists in South West England

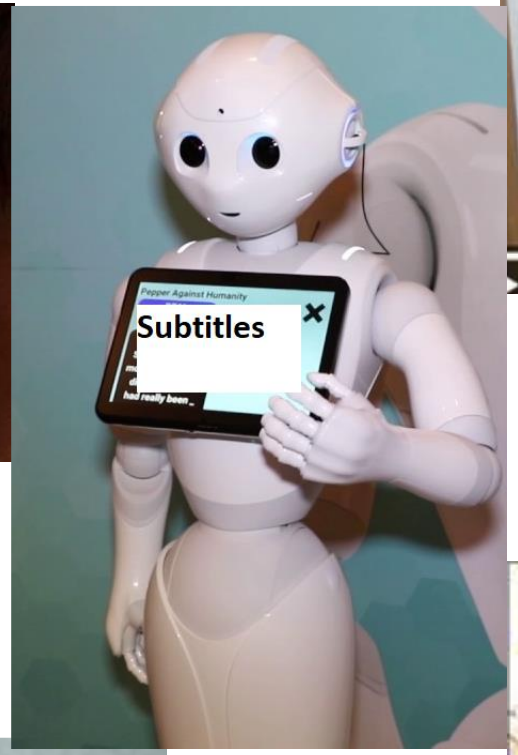
Hannah Louise Bradwell [1], Katie Jane Edwards [1], Rhona Winnington [2], Serge Thill [3], Ray B Jones [1]

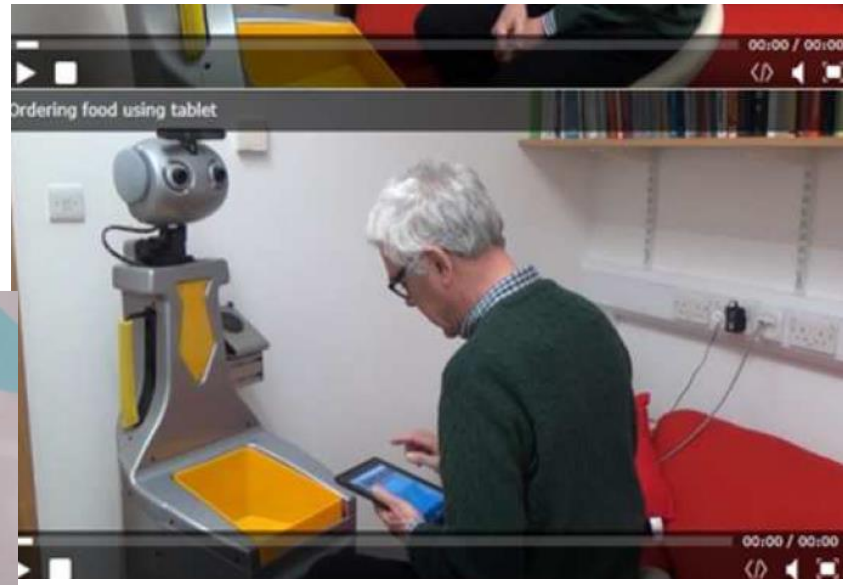
Voice and multimodal Interfaces

From Movecare project

Improving voice & interaction on robots for older people

- Groups
- Frail voices
- Hearing robot speech





HORIZON 2020

Multiple-actOrs Virtual Empathic CARgiver for the Elder

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Marta Romeo

Dr

Assistant Professor, **School of Mathema**

Assistant Professor, School of Mathema

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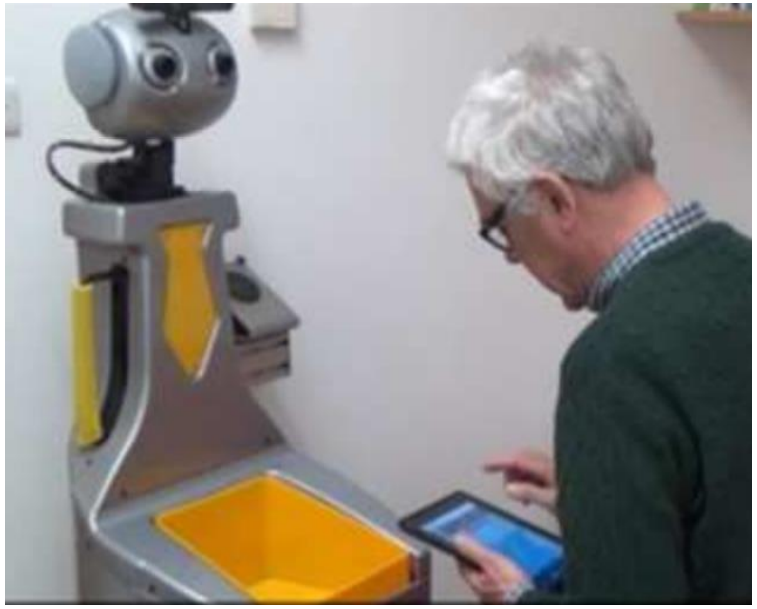
Original Paper | Published: 24 July 2019

Are older people any different from younger people in the way they want to interact with robots? Scenario based survey

Mriganka Biswas, Marta Romeo, Angelo Cangelosi & Ray B. Jones

Journal on Multimodal User Interfaces **14**, 61–72 (2020) | Cite this article

796 Accesses | **9** Citations | **1** Altmetric | Metrics



People over 65 were more like people under 21 than those aged 22–64 in preferring speech over tablet for robot–human interaction.

Differences may come from a more home based lifestyle and difficulties with vision, hearing, or dexterity rather than lack of interest in technology

GOALD
Generating Older Active Lives Digitally

UNIVERSITY OF PLYMOUTH
UNIVERSITY of STIRLING

Examples from: GOALD

Generating Older Active Lives Digitally

Leonie Cooper
Digital Health Research Associate
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One technology of interest: Virtual Reality (VR)

- Allows virtual access to culture and heritage experience – benefits to health. Using digital methods to address ‘access inequality’

- Can motivate physical activity through devices such as the ROVR – which translates physical walking/moving feet on the ROVR platform into walking through virtual environments.

Example: ROVR Treadmill

WIZDISH
ROVR

- VR as motivation for physical activity. We looked at possibilities of walking through ‘heritage’ sites.

- Social experience can host multiple users walking together in the same virtual world despite being many miles apart

GOALD
Generating Older Active Lives Digitally

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Virtual reality birthday party for 103-year-old

1 April

Joyce Penfold took a trip with virtual reality as a birthday treat

A woman celebrated her 103rd birthday with a virtual walk close to the Cornish coast.

Joyce Penfold from Tresillian House care home in Falmouth wore the virtual reality headset and explored Maker Heights in south-east Cornwall.

Leonie Cooper, from the University of Plymouth, provided the headset and said it allowed people to explore new places.

Ms Penfold said it was a "lovely" experience.

ROVR at Tresillian House

ROVR Co-design

ROVR device taken to care home staff.

ROVR device taken to a supported living home for residents to try for 6 weeks.

Feedback given to business, as a result a seated device was created.

Seated ROVR taken back to care home residents as part of GOALD ICGs.

GOALD
Generating Older Active Lives Digitally

BMJ Open Nov 2023 – Bradwell, Cooper et al

BMJ Open. 2023 Nov 23;13(11):e073307. doi: 10.1136/bmjopen-2023-073307.

Staff perceptions towards virtual reality-motivated treadmill exercise for care home residents: a qualitative feedback study with key stakeholders and follow-up interview with technology developer

Hannah Louise Bradwell [1], Leonie Cooper [2], Katie Jane Edwards [2], Rory Baxter [2], Simone A Tomaz [3], John Ritchie [4], Swen Gaudl [5], Alejandro Veliz-Reyes [6], Gemma C Ryde [7], Tanja Križaj [2], Alison Warren [2], Arunangsu Chatterjee [8], Katharine Willis [6], Richard Haynes [4], Catherine H Hennessy [9], Anna C Whittaker [3], Sheena Asthana [2], Ray B Jones [2]; GOALD project

GOALD toolkit

- Guidelines for developers to support future creation of digital products for older adults with a focus on physical activity.
  - General recommendations for all technologies
  - Virtual Reality
  - Physical activity platforms


and how it works.

Toolkit Impact Use Cases

Triangular Pixels

Created new VR game to increase PA while exploring environments with natural movements – added in tracker to monitor activity

DanceSing

Adapted current online PA platform to improve usability and accessibility – responded to usability feedback

Age Scotland

Adapted existing PA platform to include new exercises to make them more accessible to a wider audience

Mature Movers

Creating new web-based PA platform for older adults – responding to usability feedba from end users

MOTUS VR (was ROVR)

Using feedback to increase the usability of current devices by helping make their experiences easier to solo facilitate

Generating Older Active Lives Digitally

- sports and activity focused reminiscence.

Hear from those involved

The GOALD Toolkit: Impacting design through research

Research from the GOALD project led to the creation of our toolkit for developers of DHTs that promote healthy ageing. Find out how we created this useful resource and hear about its impact from developers who have tried and tested it.

The GOALD project: Involving users in the design process

Filmed at a Plymouth stakeholder event, this video gives an overview of the GOALD project and how we worked with intergenerational groups to co-design digital technologies that aimed to improve health and wellbeing for older people.

ICONIC

Intergenerational Co-design Of Novel technologies in Coastal communities

Dr Rory Baxter, Research Fellow
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UNIVERSITY OF PLYMOUTH

EPSRC

ICONIC: 30 month project – ending April 2025

The focus of this work was on digital inclusion, codesigning four novel technologies

- Virtual Reality
- Underwater telepresence
- Social games
- Voice

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EPSRC

Overview of ICONIC
Int J Adv Intelligent Systems (2024)

International Journal on Advances in Intelligent Systems, vol 17 no 3 & 4, year 2024, http://www.iariajournals.org/intelligent_systems/

Addressing Digital Exclusion via the Inter-Generational Codesign of Extended Reality, Underwater Telepresence, Social Games, and Voice AI Technologies

Ray B. Jones, Rory Baxter, Marius N. Varga, Oksana Hagen, Amir Aly, Dena Bazazian, Alejandro Veliz Reyes, Swen Gaudl

The ICONIC project, Centre for Health Technology
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ICONIC

- Partner organisations for recruitment and content
- Intergenerational approach
- 95 participants / codesigners
  - (53 older (50+ years old) and 42 younger (16-30 years old)
- Over 30 codesign workshops
  - extended reality
  - underwater telepresence
  - social games
  - voice interaction
- Also before/after interviews with older participants

Digital exclusion in coastal & rural communities

Data from ICONIC replicated existing literature highlighting older adult barriers to technologies:

- Negative attitudes towards technology
  - *"I don't think we should rely on technology"*
- Lower levels of digital skills
  - *"It's new and I'm not familiar with. It. And I'm not so sure what I'm doing"*
- Reduced device access
  - *"We forget there are people that totally rely on their landlines because they can't have the technology"*
- The poor state of coastal and rural digital infrastructure
  - *"Cornwall needs to catch up with the Internet"*
- Restricted use of digital technologies
  - *"Mobile phones, you know, we don't carry them"*

Benefits of intergenerational co-design

- Participants from both generations reported benefits from the intergenerational co-design workshops including:
  - Increased confidence & more positive attitudes to technology
    - *“I feel like my confidence has increased and I'm like, I actually know what I'm doing”*
  - Improved digital skills & wider interest in different technologies
    - *“I want more and I’m more open now to trying new things”*
  - Intergenerational interaction supports knowledge transfer between generations (Tomczyk et al., 2023)
    - *“You were able to talk to them [younger participants] about the problems you had. They then understood then actually, the younger ones didn't have so many problems”*

Generational differences in co-design approaches

- In the co-design workshops, younger and older participants had different co-design priorities:
  - Younger participants provided a more grounded approach in workshops
    - *"I think my ideas were more practical in a sense, like more realistic. And they [older participants] thought it was more like a fantasy or like that, you guys could create anything"*
  - Older participants were less constrained with their co-design ideas
    - *"In terms of ideas and general creativity in the ability to allow their imaginations to roam, I think that was more apparent in the old group"*

IONIC

EPSRC

Dr Marius Varga

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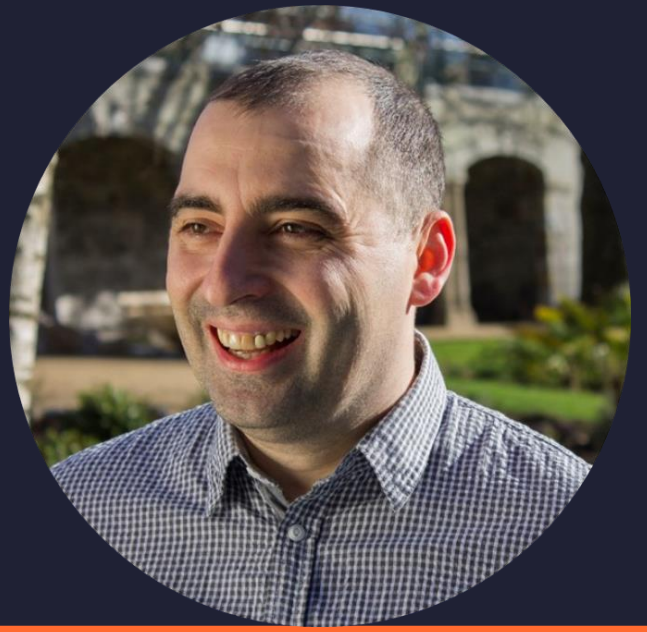


Extended Reality (XR) – Cotehele Great Hall

- National Trust – Cotehele: an atmospheric Tudor house famous for its Gloomth (gloom and warmth)
- Heritage access associated with health & wellbeing
- ICONIC explored how XR technologies could support this
- Interaction, accessibility and affordability priorities for older participants

XR - Supporting Access to Heritage & Environment

Key challenges for older user:

- Quest 2 VR headset: for comfort added weight distributing mechanical strap
- Controllers: difficult to hold due to reduce dexterity. Again added hand strap keeps controllers attached even with open hand

XR - Great Hall design

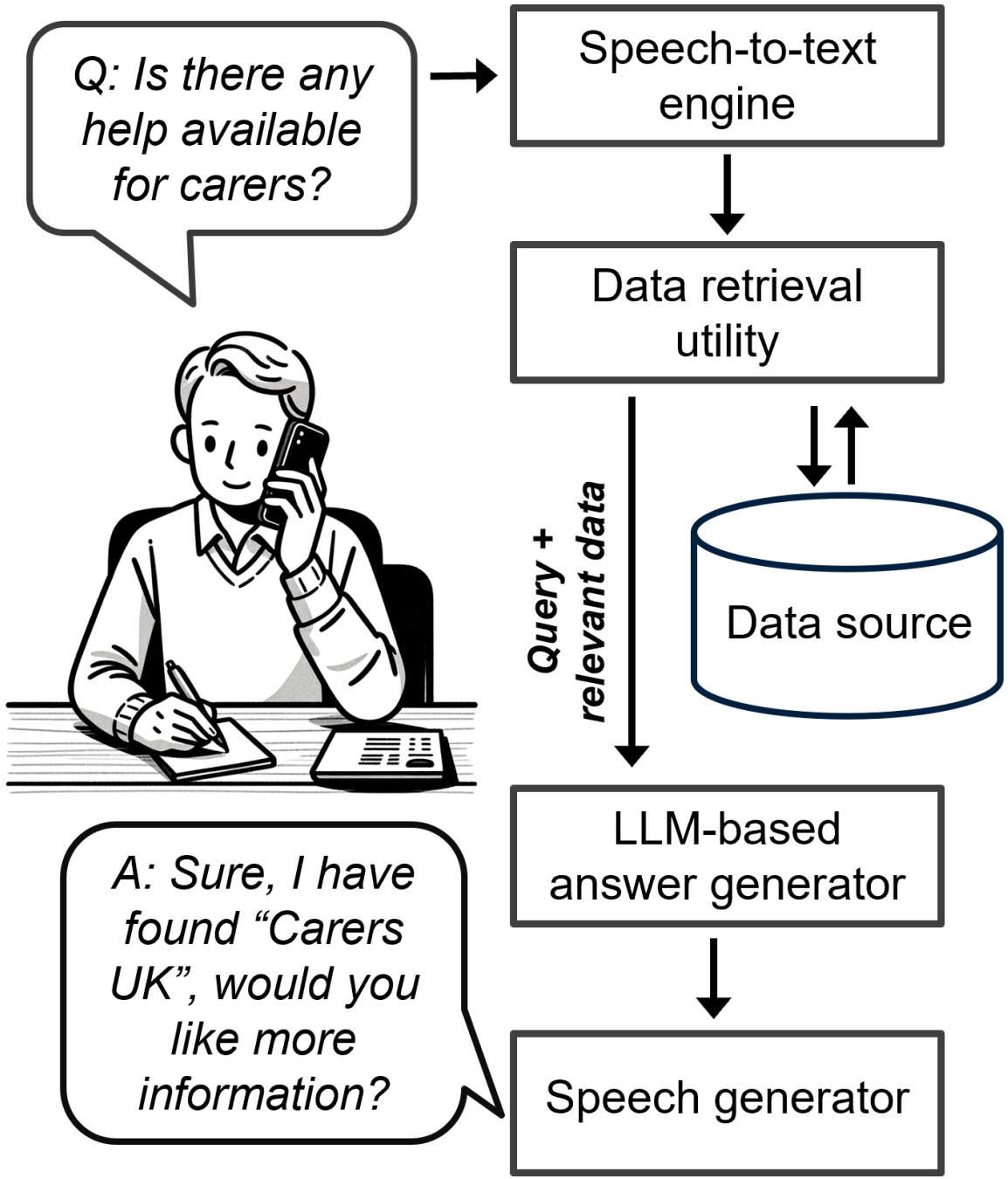
Key challenges:

- Controller buttons difficult to reach and memorise
- Solution: Reduced interaction to one button with different actions based on in-experience context
- Result: Multisensory immersive experience with all the objects interactable from a single easy-to-reach button

ICONIC

Oksana Hagen
Oksana.hagen@plymouth.ac.uk

- Can we give people who have no internet ability to ‘call the Internet’ and talk to it on an ordinary landline phone?
- Intergenerational workshops on voice AI for social prescribing
- Used methods such as Wizard of Oz to explore how older people would interact with a voice AI



Prototype voiceAI interface for social prescribing in South Cornwall can be trialled at +44 238 272 0910 – have a go!

Reminder of some of the findings and the benefits of user-centred design

Hannah: Older people wanted ‘real’ not imaginary robopets

Marta and Mriganka: Older people were more like much younger rather than middle aged people in wanting voice rather than keyboard interface

Leonie and Hannah: Care homes needed a seated treadmill on ROVR

Rory: Younger ‘practical’ versus older people’s wild imaginations

Marius: Some very practical issues in VR headsets and controllers partly addressed through extra straps

Oksana: Voice interface by phone for the unconnected and user-centred design still possible

Conclusion

Take care in making assumptions about older people

Please get out of the new one, If you can't lend your hand
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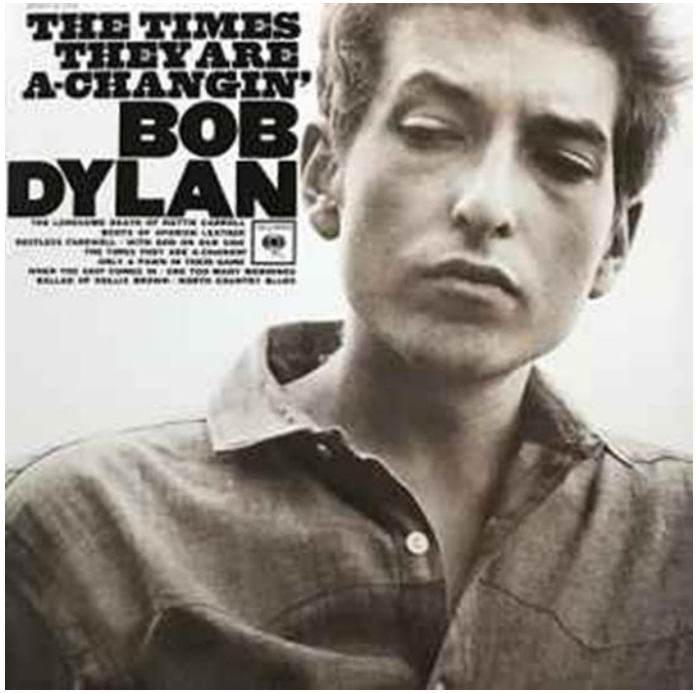

Bob Dylan at 80

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