**REF2021**

| Institution: Middlesex University |
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| Unit of Assessment: 20 |
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| Title of case study: Cultural competence and client centred care: The CARESSES Project: Enabling the development of 'culturally competent' artificially intelligent socially assistive humanoid robots |
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| Period when the underpinning research was undertaken: 1995-2020 |
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| Details of staff conducting the underpinning research from the submitting unit: |
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| Name(s):<br>Prof I Papadopoulos<br><br><br><br><br>Dr C Koulouglioti: | Role(s) (e.g. job title):<br>(IP) Prof & Head of RCTSH<br><br><br><br><br>(CK) Research Fellow | Period(s) employed by submitting HEI:<br>(IP) 1995 until the present.<br>(CK) January 2017 to December 2018 and 0.4 FTE from Feb 2019 to March 2020 |
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| Period when the claimed impact occurred: December 2017 to December 2020 |
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| Is this case study continued from a case study submitted in 2014? N |
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| 1. Summary of the impact<br>**Practitioners and professional services:** Twenty-five years of research into cultural competence underpins the CARESSES project. Its findings have developed the professional practice and ethics of healthcare workers and educators who have adopted the Papadopoulos, Tilki and Taylor model for cultural competence (Papadopoulos 2006-most recent edition) across Europe. This body of research formed the basis of the culturally competent programming for the CARESSES humanoid robot which is the focus of this case study.<br>**Public/policy debate:** The CARESSES work started a new level of parliamentary and public debate about responsible technology and novel possibilities in the use of artificially intelligent socially assistive humanoid robots in caring roles.<br>**Industry:** Our contribution to the CARESSES project was the underpinning research for the open source software that details the framework and content for cultural knowledge representation and for culturally sensitive planning and execution on the part of the robot. This implementation was shown, in the project research, to improve the mental health and reduce the loneliness of care home participants compared with exposure to a robot without this programming (Papadopoulos et al, 2020, pages 30-7, Reference 6). |
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| 2. Underpinning research (indicative maximum 500 words)<br>Papadopoulos and colleagues have led research into cultural competence in healthcare and education delivery since 1995 developing the model used in CARESSES. Within the model, 'cultural competence' is seen as the culmination of the four stages comprising: growing cultural self-awareness on the part of a care deliverer, the development of knowledge of the culture and health beliefs of client groups, learning to deliver health and social care in an equal and non-oppressive way and finally the synthesis and application of previously gained awareness, knowledge and sensitivity in practice.  Cultural competence is the ability to respond effectively to people from different cultures and backgrounds, resulting in the delivery of services that meet the cultural and communication needs of patients. It is seen as crucial for high quality, patient and client-centred care.<br>Because of her reputation for research into cultural competence (see references below) Papadopoulos was invited to join a collaborative, multi-institution international project in the field of smart healthcare systems (the CARESSES (Culture-Aware Robots and Environmental Sensor |
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Systems for Elderly Support) Project – commenced January 2017). The project aim was to develop, build and evaluate a culturally competent assistive humanoid robot. Its starting point was an existing assistive robot built by research partner SOFTBANK Robotics, known as 'Pepper', which was designed to communicate with people through body movements and voice. Papadopoulos' contribution was to take this existing socially assistive robot and turn it into a culturally competent robot. Her contribution is innovative, as cultural competence has tended to be neglected by researchers in the field of smart healthcare systems and assistive robotics.

Her approach is based on the understanding that if socially assistive systems are to become more autonomous and intelligent, enabling them to respond closely to human need, then 'cultural competence' becomes indispensable for such systems to be accepted, in the same way that it is crucial for human caregivers, as demonstrated by her research e.g. with migrants and refugees (Papadopoulos *et. al.* 2004 Ref. 1), minority ethnic groups (Papadopoulos et al 2007 Ref. 2) and by studies conducted by others who cited her work (c1550 citations and c67K readings as reported by ResearchGate). She developed a working definition of a 'culturally competent robot' as one able to identify a person's cultural beliefs, behaviours, needs and preferences, respond to them with sensitivity and cultural appropriateness, while offering them a safe, reliable and intuitive system, specifically designed to support active and healthy living.

The CARESSES Project was funded by the European Commission under the Horizon 2020 scheme and the Japanese Ministry of Internal Affairs and Communications. The following universities formed the multidisciplinary research team: Genova (Italy) and Orebro (Sweden) both providing AI, robotics and software development expertise, Middlesex (UK) with expertise in cultural competence, Bedfordshire (UK) providing expertise in evaluation of complex public health interventions. Two EU based commercial companies were involved: the international SOFTBANK robotics (France branch), and ADVINIA a UK network of social care providers. Three Japanese universities were involved: JAIST (smart ICT environments and human interaction), Nagoya and CHUBU, both providing expertise in human interaction.

Papadopoulos developed care scenarios based on her established model of cultural competence (Papadopoulos 2006 Ref. 3, 4) and gathered observational and video-recorded data of everyday activities of older people from the three target cultural groups (Japanese, Indian, English) which captured in detail visible cultural elements as well as enactments of often invisible elements such as values, feelings, etc. From this data theoretical models were produced and used as the basis for open source software for the AI robot (Bruno *et. al*. 2019 Ref. 5). This not only enables understanding and learning about an individual's cultural identity but also ensures that the robot is able to assess, act and review actions without stereotyping. Papadopoulos and colleagues at Middlesex created the content, models and guidelines for a culturally competent robot whilst the other partners enabled the application and operationalisation. A prototype was developed and successfully tested in the latter half of 2019.

**3. References to the research**

**1. Papadopoulos I, *et al.*** (2004) Ethiopian Refugees in the UK: Their adaptation and settlement experiences and their relationship to health. Ethnicity and Health. Vol. 9, No. 1, pp 55-73. ISSN1355-7858.

**2. Papadopoulos I, *et al.*** (2007). An exploration of the meanings and experiences of cancer of Chinese people living and working in London. European Journal of Cancer Care, 2007, 16, 424–432. DOI: 10.1111/j.1365-2354.2007.00785.x

**3. Papadopoulos I.** (2006) (Ed). Transcultural Health and Social Care: Development of Culturally Competent Practitioners. Churchill Livingstone Elsevier. Edinburgh. ISBN 13: 978 0 443 10131 1

4. **Papadopoulos I. and Koulouglioti C**. (2018). The Influence of Culture on Attitudes Towards

Humanoid and Animal-like Robots: An Integrative Review. *Journal of Nursing Scholarship,* Nov;50(6):653-665. doi: 10.1111/jnu.12422

5. **Bruno, B., Recchiuto, C.T., Papadopoulos, I.** *et. al.* (2019). Knowledge Representation for Culturally Competent Personal Robots: Requirements, Design Principles, Implementation, and Assessment.*International Journal of Social Robotics,* pp.1-4 https://doi.org/10.1007/s12369-019-00519-w

6. **Papadopoulos, C** *et. al.* (2020) Work Package 7: End-user evaluation D7.2: Final report on WP7. CARESSES PROJECT, European Union and Ministry of Internal Affairs and Communication, Japan.

## 4. Details of the impact

The claimed impact of this research centres on i) adoption by practitioners and professional services, ii) raised public and policy awareness and debate on responsible technology and novel possibilities in the use of artificially intelligent socially assistive humanoid robots in caring roles and iii) industry - on enabling the development, production and testing of a culturally competent socially assistive humanoid robot.

### i) Practitioners and professional services

### Evidence of adoption of best practice by educators across Europe

The Papadopoulos Tilki and Taylor model of cultural competence was first published in 1998 and was later enhanced by Papadopoulos in 2006 (Papadopoulos 2006). Over the last 20 years the model has been adopted by institutions educating health care students, primarily nurses, in Europe and beyond (see corroborative statement No9). The model underpins the IENE programme (Intercultural Education for Nurses in Europe) established by Papadopoulos in 2008. To date the programme has received EU funding for 10 IENE projects with a total of 16 European countries and 24 different institutions took/taking part and basing their education on this model. To date the projects have delivered 2 MOOCs (Massive Online Open access Courses) and will be delivering a third in 2021 to approximately 1,500 people. It has delivered 9 seminars to 270 people, 3 webinars (over 200 people), trained over 50 people to become MOOC facilitators, delivered a conference to over 100 people, delivered 5 face to face training courses on cultural competence to over 200 people and provided access information on the created numerous tools via Twitter, Facebook and newsletters to thousands of people. Its resources have been made open access and can be found at www.ieneproject.eu/ , http://ienerefugeehub.eu/, https://iene7.eu/ , https://iene-lgbt.com/

The Papadopoulos model of cultural competence, the numerous projects built on it and the number of nurse educators, students and practitioners involved across the 16 European countries indicates the breadth of impact and influence on them (see testimonial: Corroboration document 9).

### ii) Public and policy awareness and debate

### Impact on and interaction with policy-makers

This takes the form of enabling a more concrete and focused discussion of the potential and current challenges regarding the use of smart and robotics technologies for assisting older people.

Two important milestones in the development of this policy direction which have resulted from the Middlesex work are:

(i) in October 2018 the CARESSES robot was the first robot ever to give evidence to a Parliamentary committee, in this case the Education committee, making the committee newly aware of the ability and potential of such robots. This event was featured by all major UK and international news outlets, including BBC, the Daily Mail, The Guardian, Japan Times, The Sun, abcNEWS, the Independent, Wired.

(ii) in December 2018 the UK Parliamentary Office of Science and Technology (POST), Robotics in Social Care called on CARESSES researchers to contribute evidence to them via the POSTnote process, introducing robotic technology and the main ways it has been developed for use in social care. The POSTnote process assesses evidence of the impact of robotics, including on costs and quality of social care as well as on the present workforce, and explores related ethical, social and regulatory challenges. See Corroboration document 1.

**Impact on debate in global media**

Presence in the media continued in the following years with news and interviews in newspapers, TV and radio channels in UK, Italy, Japan, Sweden (Sunday Express, the Sun, the Daily mail, New Statesman, The Guardian, The Telegraph, BBC (Corroboration documents 4,5), TG5 Italian Television, Il Corriere della Sera, Mind, Sky tg24, NHK, MRO Hokuriku Broadcasting Co., STV - Sweden television). In October 2018, the project was cited in Nature (Vol 562) in an article on innovative Japanese research. By September 2020, as a result of media uptake, the CARESSES project had stimulated numerous public debates on the desirability of smart, culturally competent robots, and on the ethical issues related to them such as confidentiality, the replacement of human carers, and on technical issues such as maintenance and safety. These issues had been raised before, but as more factual and evidenced based information emerged, such as that produced by this project, the ensuing debates are becoming more balanced and informed. The think tank Doteveryone, which promotes the responsible use of technology to meet societal needs, referenced the project as intensifying public debate. See Corroboration document 2.

**iii) Industrial impact: Production and deployment of the robot**

The CARESSES project set out to significantly improve the acceptance of elder care robots by developing and testing the first ever culturally competent robot. Our research team produced the theoretical foundation and generated the data that formed the software basis for the culturally competent abilities of the robot. (A project publication, in January 2020, of open source software details a framework for cultural knowledge representation and for culturally sensitive planning and execution in artificial intelligence: Corroboration 6). This programming enabled the robot to autonomously reconfigure its way of acting and speaking when offering a service, to match the culture, customs and etiquette of the person they are assisting, combining culture and person specific knowledge, and because of this combination of knowledges to avoid stereotyping. This included for example how conversation topics changed, as well as modes of address, social distancing, gestures and appreciation of key dates.

The robot was initially put into operation during the latter part of 2019 for extensive testing in the following settings: Advinia Healthcare care homes (UK; project partner Corroboration 3); the HISUISUI care home (Japan); the iHouse facility at JAIST (Japan; project partner), a duplex apartment that is fully equipped with sensors and smart appliances for home automation. In February 2020 Mark Easton (BBC News Home Editor) visited one of the Advinia care homes and interviewed residents who had taken part in the trial as well as staff and members of the Caresses team. The programme was broadcast on the 7th September. Easton presented the arguments for and against the deployment of robots similar to the CARESSES robot and showed footage from his interviews. In particular, and in illustration of the impact of the elements of cultural competence programmed into the robot, an interview with a resident who had lived with the robot for 2 weeks made clear how he had benefitted from having the robot as a companion during that time. The resident reported that the robot was 'friendly' and knew about his cultural background; it asked relevant questions.  These abilities were demonstrated when the robot was brought in to talk to the resident. The resident was shown to appear delighted to see the robot again and started a

conversation demonstrating the acceptability of the robot and the impact it had on this individual. See Corroborating document 8 from Newham Magazine.

**5. Sources to corroborate the impact** (No. refers to Corroborating document number)

*1.      POSTNOTE 591 December 2018 Robotics in Social Care. The Houses of Parliament, Parliamentary Office of Science and Technology, Westminster, London* references (Ref 148) the project in its discussion of promising options for the use of robotics in social care.

2.      The Think tank 'Doteveryone' references the project as intensifying debate:
'We need a new conversation around care and automation' January 29, 2019 Doteveryone
https://www.doteveryone.org.uk/2019/01/we-need-a-new-conversation-around-care-and-automation/

3.      Advinia Healthcare became the first care provider to deploy and test Pepper robots in its care homes, in a bid to ease pressure on care staff and the sector. Advinia Healthcare operates 16 care homes and two home care agencies in the UK.

The care group's executive chairman Dr Sanjeev Kanoria told the website carehome.co.uk:

"Robots by supporting care workers can reduce errors in medication and assist them with advanced technology to help vulnerable residents, live safer independent lives in care homes and at home. This will revolutionise the care of the elderly by supporting hard working care workers with modern technology." (https://www.carehome.co.uk/news/article.cfm/id/1601100/Care-robot-quizzed-by-MPs-says-it-will-help-elderly-in-care-homes-and-at-home)

4.      'Robots could help solve social care crisis, say academics' (bbc.co.uk, 30 January 2017) John Humphrys on the Today programme interviews members of the Middlesex University research team on their views on culturally aware robots and the likelihood of their use in care settings http://www.bbc.co.uk/news/education-38770516

5.      Emotional and culturally aware robots could soon be looking after the elderly (dailymail.co.uk, 30 January 2017)
Feature on Middlesex University research on culturally aware robots includes quote from Professor Irena Papadopoulos. http://www.dailymail.co.uk/sciencetech/article-4171716/Could-ROBOTS-soon-elderly-company.html

6.      The paper on the EU Cordis site from the developers of the robot detailing how they used the Papadopoulos model as the basis for the development of the open source software used in the robot: Work Package 3: Culturally Sensitive Planning and Execution Deliverable D3.4: Open Source release: software for culturally sensitive planning and execution. Available at: https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5cba85183&appId=PPGMS

7.      The producers of the robot detail how its cultural modules, Cultural Knowledge Base (CKB), Culturally Sensitive Planner and Execution Module (CSPEM) and Culturally Aware Human-Robot Interaction Module (CAHRIM) are based on the Papadopoulos model:
'When innovation embraces cultural background to ensure robots' performances and acceptability' at https://developer.softbankrobotics.com/blog/caresses-smart-and-friendly-robots-elderly

8.      The Newhammag. Issue 412 // 09 Aug – 12 Sep 2019 // page 15. Care home resident speaks about the benefits of the robot at https://www.newham.gov.uk/downloads/file/1305/newham-mag-issue-412-pdf

9.      Impact of the Papadopoulos model of culturally competent care in the training of nurses in Europe. Statement 9 from Program Coordinator, University of South-Eastern Norway.