TRIL Centre

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Convergence of Forces Driving Change in Today’s Healthcare System

Double # of people >60 by 2050

Shortage of qualified healthcare professionals

Healthcare costs rising to unsustainable levels

new models of care required
Quality of Life

COST [ $/Day]

- Staying at Home
- Residential Care
- Acute Care
Addressing the Challenge

- Multiple stakeholder input needed to deliver:
  - Comprehensive understanding of the needs of and issues facing the ageing population
  - Enhanced insight into complex interactions between biopsychosocial variables in determination of capacity for independence
  - Identify potential role of technological solutions and design and evaluate new technology enabled care models for promotion of independent living and delivery of healthcare in the home
  - Business case for new models of care that result
approach

Clinically informed technology development rather than technology push

User centred ‘participatory’ design

Deployment and evaluation of technology in real homes

EXPERTISE

CORE RESEARCH FOCUS AREAS
- Perceptual Function
- Cognitive Function
- Falls Prevention
- Wellness & Exercise
- Social & Mental Health

RESEARCH ENABLING PLATFORMS
- Cohort & Dataset
- Technology & Design Platform

EXPERTISE
- Healthcare Economics
- Biomedical Engineering
- Neural Engineering
- Exercise & Muscle Physiology
- Biomechanics & Rehabilitation Science

- Multisensory Cognition
- Old Age Psychiatry
- Medical Gerontology
- Psychology
- Ethnography

Healthcare Economics
Biomedical Engineering
Neural Engineering
Exercise & Muscle Physiology
Biomechanics & Rehabilitation Science

Perceptual Function
Cognitive Function
Falls Prevention
Wellness & Exercise
Social & Mental Health

Core Research Focus Areas

Research Enabling Platforms

Expertise
Cohort & Dataset

- Clinic situated in large city centre hospital in Dublin
- 625 volunteer participants to date

- Has enabled collection of rich biopsychosocial dataset using custom designed multifactorial ‘TRIL Assessment’
  - Longitudinal follow-up ongoing

- Dataset facilitates programme of ageing research
  - Building understanding of interactions between bio-psycho-social factors in the determination of capacity for independence

- TRIL volunteers also contribute to user centred design and technology evaluation process
Tech & Design Platform

Technology Building Blocks

User-Centred Design Approach

Technology Prototypes

Field Evaluation

Kinematic, Physiological and Ambient Monitoring

Cognitive Function and Alertness stimulation

SOFTWARE ENGINEERING

BIOMEDICAL ENGINEERING

INTERACTION AND INDUSTRIAL DESIGN

ETHNOGRAPHY

INFRASTRUCTURE AND DATABASE MANAGEMENT

HUMAN COMPUTER INTERACTION

FIRMWARE/HARDWARE DESIGN ENGINEERING
discovery ... design ... implementation ... evaluation
Gait Analysis Platform

- Development of wimu based gait analysis platform and validation against gold standard

- Strong emphasis on usability
  - out of the box use

- Deployment of platform in cohort for
  - Falls risk assessment using instrumented gait tests
  - Biofeedback during targeted exercise intervention for falls risk reduction
Validation for measurement of temporal and spatial variables against gold standard systems

- Marker based motion capture
- Force platform
- Pressure sensitive walkways
Instrumented TUG Test

- Evaluated against datasets from 349 volunteer participants

- Mean faller identification accuracy - 80%

- Performs significantly better than existing approaches
  - Standard TUG & Berg Balance Score - 60%
Building Bridges

Design and develop group communication technology that can be used intuitively by older adults to support social connection and reduce the risk of loneliness and social isolation.

- Access to the internet and email increases perceived independence and decreases levels of loneliness (White et al., 1999)
- Internet technology is often inaccessible because of sensory, physical and cognitive demands, software design and meaning or perceived usefulness.
Activity Recognition in Health & Sport

Sensor Based Exercise Biofeedback
Activity Recognition in Health & Sport

IMU set up on the athlete, with sensors placed on the proximal and distal forearms.

\[ \frac{z}{y} \text{ acceleration ratio} \]

\[ \text{service speed (km/h)} \]

Fig. 2 Mean head total acceleration during the jump was consistently higher in novice riders. This effect was enhanced when riding the inexperienced horse.
Sensor Based Exercise Biofeedback

Managed solution
Implementation, monitoring, and progression of exercise for rehabilitation

Designed with clinical needs in mind
Based on using client’s own smart-phone as a motion sensor

Unique exercise programme
Created using personalized exercise template system
Pathway/target in visual interactive biofeedback environment

Clinical studies
Similar training benefits to supervised exercise
Large improvement in compliance and motivation

Very strong feedback from patients
Electrical Muscle Stimulation Research Group in UCD

- **Low Back Pain**
- **Incontinence**
- **COPD**
- **Heart Failure**
- **Sporting Application**
- **Spinal Cord Injury**
- **Diabetes & Obesity**

Calorie Consumption using EMS in Obese Adults
• Questions

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• www.trilcentre.org

• www.clarity-centre.org
Capabilities

• Design
  – *Ethnographic ‘participatory’ design*
  – ‘Turn Key’ clinical application development
  – Relevant clinical domain expertise input

• Implementation
  – *Home / community setting*

• Evaluation
  – *Usability*
  – *Economic efficacy*
  – *Clinical efficacy*