STARFISH: a team-based smartphone app to increase physical activity in older adults and stroke survivors
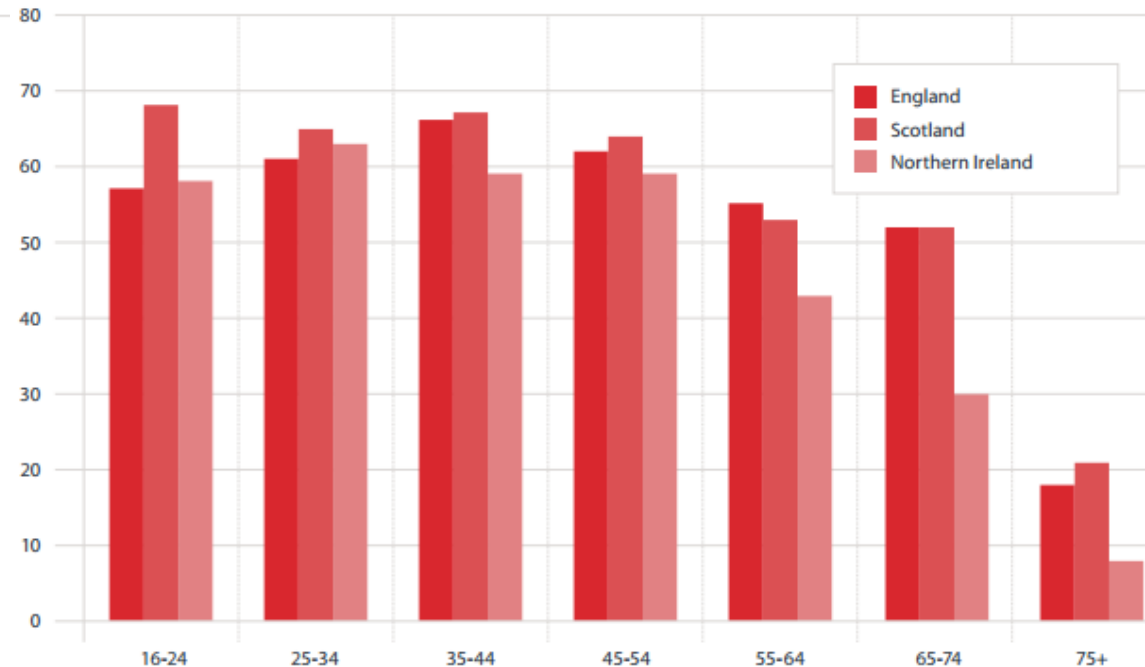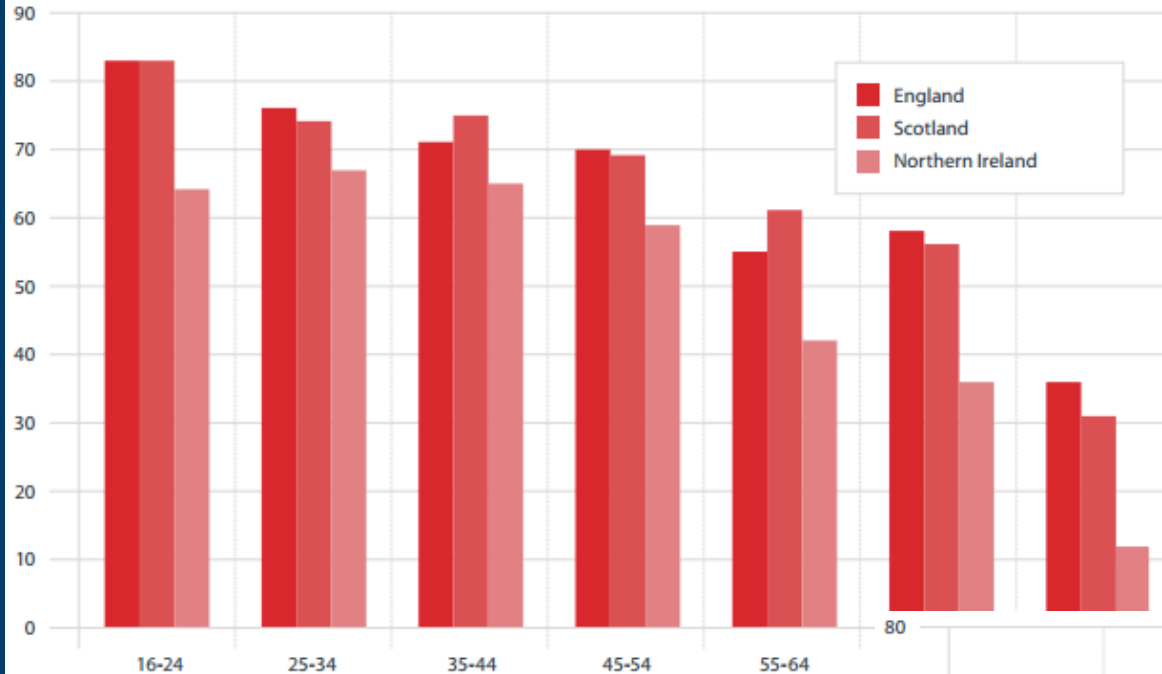
Cindy M Gray, Sally Wyke and Lorna Paul

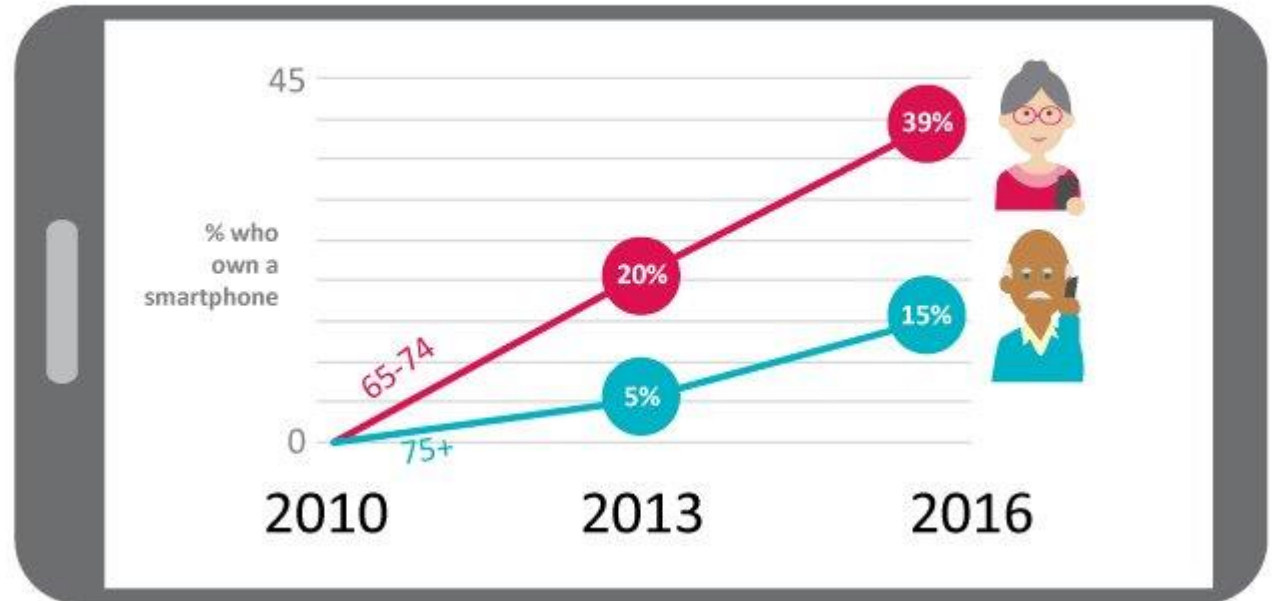British Heart Foundation: Physical activity statistics 2015

The rise in smartphone ownership among over-65s

% who own a smartphone

45

2010: 65-74 and 75+ start at 0

2013: 65-74 = 20%, 75+ = 5%

2016: 65-74 = 39%, 75+ = 15%

Ofcom 2017

University of Glasgow

- STARFISH is a smartphone app designed to encourage older people to be more physically active

- Smartphone sensors record number of steps taken per day

- Each 'player' is represented by a fish in the STARFISH 'fish tank'

- When player is active, their fish blows bubbles and swims faster

 (and makes a gurgling noise!)

My Fish

My Steps: 587

My Fish

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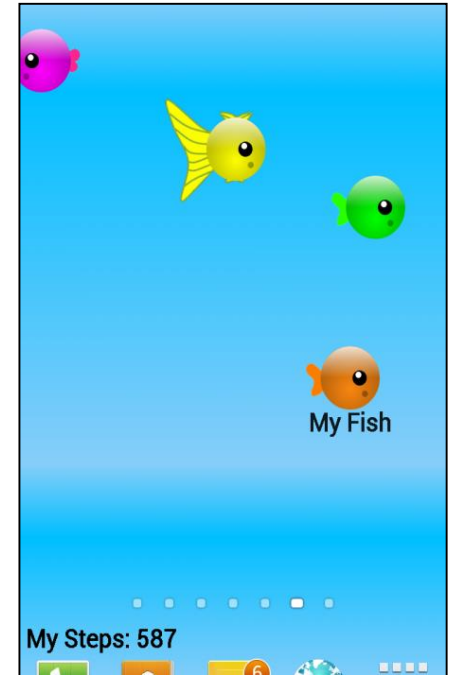
Label	Definition	An example of how the technique is operationalised in STARFISH
FEEDBACK AND MONITORING		
Self-monitoring of behaviour	Establish a method for the person to monitor and record the outcome(s) of their behaviour as part of a behaviour change strategy	Step count monitoring is integral to the STARFISH application and visible to the user as real-time step counts. Users can also view their daily step count history both numerically and graphically to monitor change in activity over time.
Feedback on behaviour	Monitor and provide informative or evaluative feedback on performance of the behaviour	The fins and tail of users' fish grow as they progress towards their weekly step count target.
Monitorin... others wi...		
GOALS A...		
Goal sett...		...end of ...% for the
Discrepa... current b...		...he user ...fall
Action pl...		...ted to
SOCIAL ...		
Social su...		...ly step
COMPAR...		
Social co...		...arget.
REPETIT...		
Graded t...		...ieved
	behaviour is performed	
REWARD AND THREAT		
Non-specific reward	Arrange delivery of a reward if and only if there has been effort and/or progress in performing the behaviour	The fins and tail of each user's fish only grow as their step count increases towards their weekly target. The weekly group reward (a sea creature swimming in the group tank) is contingent on all group members achieving their daily step count targets.
Social reward	Arrange verbal or non-verbal reward if and...	A 'happy Starfish' congratulates users only if they have achieved their step count target the previous day.

Integral BCTs within STARFISH

- Self-monitoring
- Goal setting
- Feedback on behaviour

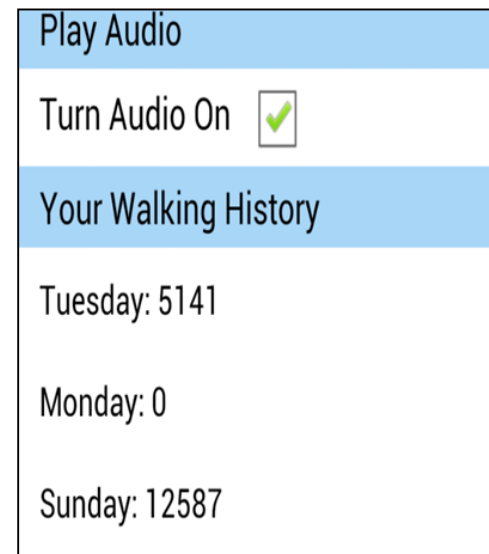- Social comparison
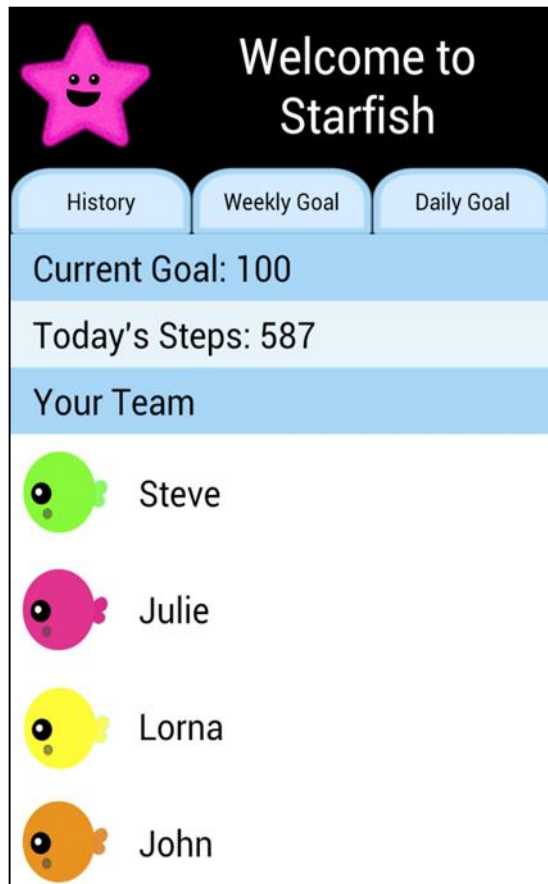- Graded tasks
- Rewards
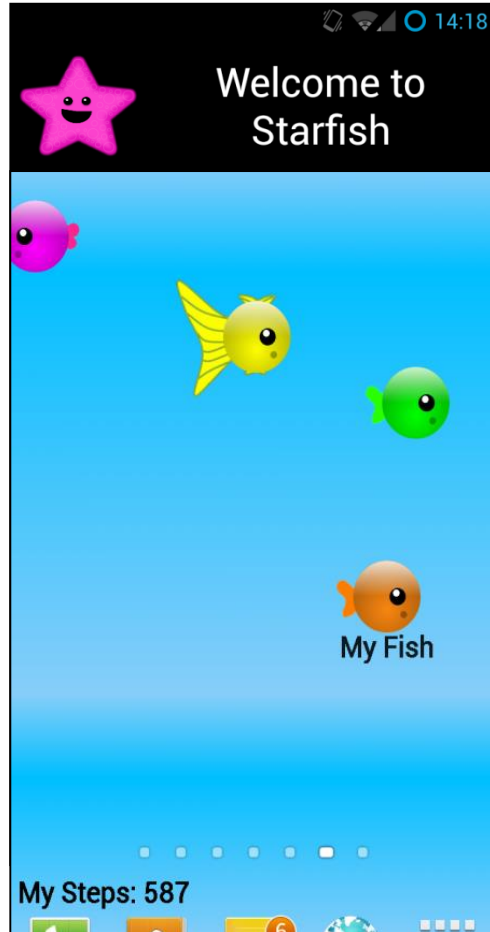
- STARFISH is undertaken in teams of 4 players

- Each player's fish is a different colour
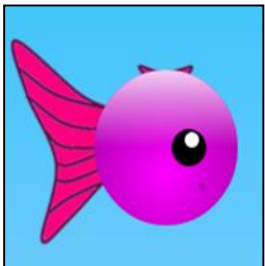 - ➢ All players can see how active other members of their team are

- Each player has their own daily physical activity (step) target

- (Real time) individual daily step count

- Weekly step count history
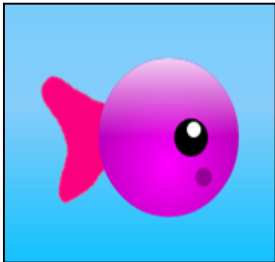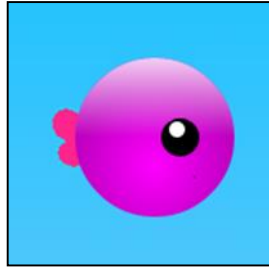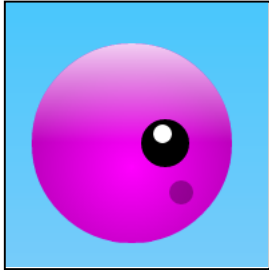
- Week 1 target – baseline steps (over 7 days) plus 10%
- The fish fins and tail grow if player achieves their daily target
- Personalised motivational feedback
- If player achieves their step count target on 5/7 days:

10% for the following week
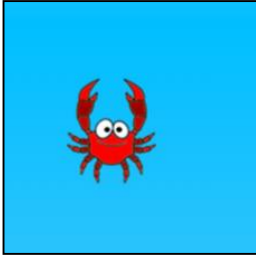
- Each week a new creature appears in STARFISH tank if whole team achieves step targets on 5/7 days
  - ➢ Crab
  - ➢ Octopus
  - ➢ Seahorse
  - ➢ ………
  - ➢ Starfish

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- **16 older men and women (4 teams)**
  - ➢ 8 women (71.1 years, +/- 5.2)

- **Undertook STARFISH for 6 weeks**

- **Mixed methods**
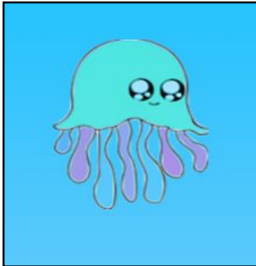 - ➢ Post-intervention focus groups – user experience
  - ➢ Pre-post outcome measurement (baseline and 6 weeks)
    - ▪ Objective physical activity (daily step counts from phone sensors)
    - ▪ BMI
    - ▪ Blood pressure
    - ▪ Heart rate

Paul et al. J Rehabil Assist Technol Eng 2017 4; 1–10

Bupa
UK Foundation

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Acceptability and feasibility

- 15/16 completed study

Pretty straightforward (SF13)

Maybe a wee bit of explanation would be helpful (SF01)

I was looking at the tails, to see if I can get a bigger tail (SF05)

I think you sort of realise as well, **how little you do some days**. Before we had those phones **I could do nothing sitting on the couch all the afternoon before**, whereas after **I felt I need to get up from here and actually do something**. (SF12)
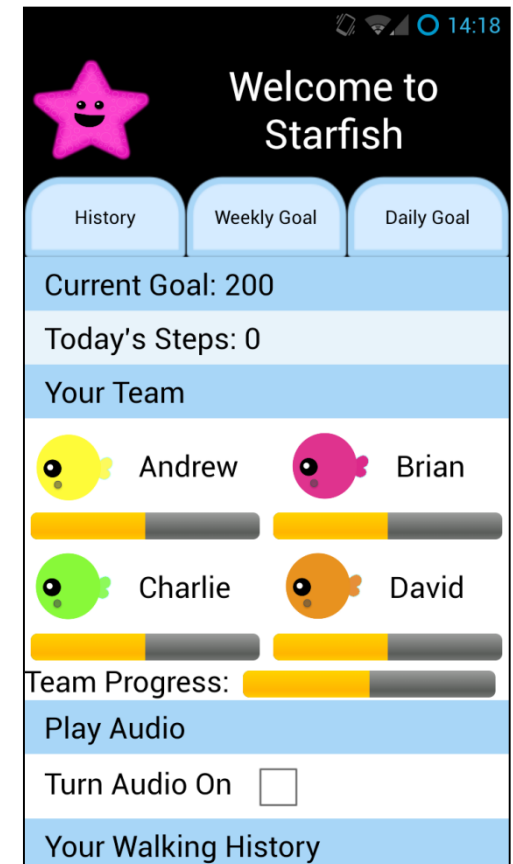
initially it was on Thursday, then it moved to a Friday, **you did look at your phone more often to see if your creatures come on**, you know SF11: **You started that… "We haven't got it. We haven't got the creature yet"**. (SF12)

Outcomes

	Baseline Mean (sd)	Week 6 Mean (sd)	Mean Change (sd)	95% CI	p-value (1-tailed)	Effect size d
Step count (N=8 from phone)	9443 (3952)	10773 (2659)	1330 (2358)	(-639.9, 3302.3)	0.077	0.56
BMI (kg.m^{-2})	23.1 (4.1)	23.0 (4.2)	-0.1 (0.3)	(-0.15, 0.40)	0.162	0.33
SBP (mm Hg)	141.1 (12.5)	137.0 (8.2)	-4.1 (9.4)	(-3.7, 12.0)	0.128	0.44
DBP (mm Hg)	87.0 (11.7)	84.2 (8.4)	-2.8 (11.0)	(-6.5, 12.0)	0.252	0.25
HR (bpm)	69.9 (13.7)	69.0 (17.8)	-0.9 (7.4)	(-5.34, 7.09)	0.374	0.12

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Chest Heart & Stroke Scotland

- **4 stroke survivors from Stobhill Hospital, Glasgow**

- **The existing STARFISH application was adapted by**

  - screen scheme colour changed,

  - text and tick boxes enlarged,

  - sensitivity of the touch screen reduced

  - progress bars added

- **Smartphone sensors calibrated for stroke gait**

- **5% step count weekly increment**

Paul et al. Top Stroke Rehabil 2016 23:170-7

14:18

Welcome to Starfish

| History | Weekly Goal | Daily Goal |

Current Goal: 200

Today's Steps: 0

Your Team

Andrew   Brian

Charlie   David

Team Progress:

Play Audio

Turn Audio On

Your Walking History

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- 24 stroke survivors (13 women: age 55.2, 4.2 years since stroke)
  - intervention (n=16) or control (n=8) groups

- Intervention group undertook STARFISH for 6 weeks

- Control group – usual care

- Mixed methods

  - Outcome measures

Daily step count (activPAL™)	Daily sedentary time (activPALTM)
Heart rate	Blood pressure
Body Mass Index	Fatigue Severity Scale
Instrumental Activity of Daily Living Scale	Ten-Meter Walk Test
Stroke Specific Quality of Life Scale	Psychological General Well-Being Index

  - Focus groups – user experience

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	Intervention Group (n=15)		Control group (n=8)		Group/ Time Interaction
	Baseline	Week 6	Baseline	Week 6	
Step count	3993 (2384)	5774 (2926)	3640 (3498)	2936 (2409)	0.005*
Sedentary time† (hrs)	19.48 (1.81)	18.54 (2.16)	19.94 (1.78)	19.36 (2.76)	0.705
10MWT (m/s)	0.36 (0.19)	0.42 (0.18)	0.37 (0.26)	0.41 (0.19)	0.967
SSQoL	171.3 (36.3)	185.4 (35.4)	169.0 (50.1)	176.8 (55.5)	0.313
IADL	5.3 (1.9)	5.3 (1.4)	4.8 (2.3)	5.5 (1.6)	0.090
PGWBI	76.7 (17.7)	79.8 (15.0)	79.4 (14.8)	82.6 (19.8)	0.961
FSS	3.6 (1.4)	3.1 (1.4)	4.1 (1.4)	5.2 (1.6)	0.003*

10MWT= Ten Meter Walking Test, SSQoL=Stroke Specific Quality of Life scale, IADL,=Instrumental Activities of Daily Living Scale, PGWBI= Psychological General Well-being Index, FSS= Fatigue Severity Scale.

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Its surprising how many steps you are actually doing in the house

We live in sheltered accommodation.... They were like "Hi [name] have a seat" and I was "sorry I have to do my steps"

I was looking at the tails to see if I can have the biggest one

You can sit all day watching TV but now we're in a team so there's motivation

Have done a lot more walking than I have done before

..my hips don't get sore when I'm walking now... I've lost a bit of weight as well

- Grant secured from Chest, Heart and Stroke Scotland for fully powered randomised controlled trial

- 58 people in each arm of the study: intervention vs control (recruited in blocks of 8)

- 4 month intervention with 2 months follow up
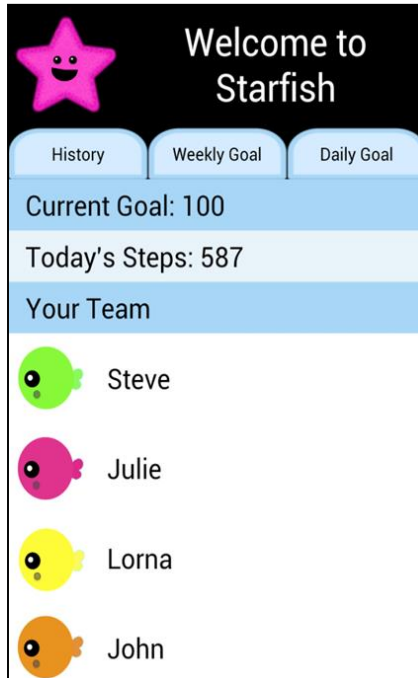
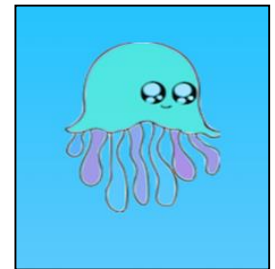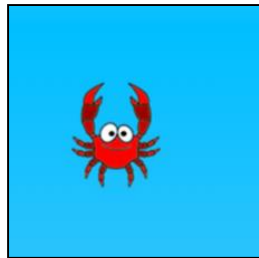Outcome measures at baseline, 4 months and 6 months (i.e. 2 month follow up)

- Daily steps (activPAL^{TM})

- Sedentary time, walking time and intensity (activPAL^{TM})

- Six-Minute Walk Test (6MWT).

- 10-Metre Walking Test (10MWT)

- Nottingham Extended Activities of Daily Living (EADL)

- Fatigue Severity Scale (FSS)

- Stroke Specific Quality of Life (SSQOL)

- Hospital Anxiety and Depression Scale (HADS)

- Blood pressure

- Heart rate

- BMI

- Bloods (total cholesterol, triglycerides, HDL cholesterol, liver function [ALT, AST, GGT], C-reactive protein, HBA1c)

UNDERWAY

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- The STARFISH app is acceptable, feasible and shows potential to increase physical activity in older adults and stroke survivors

- A full RCT of a 4-month intervention with stroke survivors is underway

- Funding is being sought to work with independent developer to support roll-out of STARFISH through NHS and physical activity providers