Report on the *Research Challenges* Workshop

Held at the GetAMoveOn Network+
1st Symposium 24th and 25th May 2017

collaboration across domains

measuring physical activity

addressing individual goals

finding reasons for inactivity

extrinsic vs. intrinsic motivation

continuous engagement

tailored interventions

research methodologies

meaningful use of technology

informing policymakers

user autonomy

data quality

cultural & environmental factors

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Overview of the GetAMoveOn Network+

Funded by the EPSRC, the GetAMoveOn Network+ (GAMO) brings together experts in sensor networks, data analytics, interactive visualisation, human-computer interaction, online citizen engagement, behaviour change, sports and exercise with the aim of transforming health through enabling mobility. We do this through our events, newsletter and funding for member-led activities and research.

In our first year, the network has grown in number from around 60 founding members to over 140, including members from 71 institutions across 13 countries – stretching across the globe from the UK to Australia. In the first year, we have organised a course on Inbodied Interaction which was held at the CHI 2017 conference in Denver, USA and a workshop on using technology to help older adults be physically active. We have also funded a set of 8 'thinkpieces' with the aim of identifying topics and research agendas that could subsequently inspire future research projects and new collaborations.

Development of this Report

In May 2017 the 1st GAMO Symposium took place with the aim to bring together a range of experts to help to scope and define approaches, and stimulate debate, about the role of current and future technologies in enhancing levels of activity and movement in one of our three target groups: schools, workplaces, and communities of older adults.

Full details of the symposium including the symposium proceedings with abstracts of all the presentations can be found on our website:

https://getamoveon.ac.uk/events/symposium-2017

The symposium closed with a workshop in which delegates were asked to write down individually what they considered to be the main *research challenges and goals* for GAMO, and then took part in a group activity to brainstorm *research questions* related to the challenges and the target groups. They also worked in groups to brainstorm ideas for solutions to engage people in more physical activity.

This report is based on a thematic analysis of the handwritten notes of the discussions which took place, and the flip-chart posters produced during the group activities. The structure of the text is based on the key themes that have been identified (which are reflected in the 'topic cloud' on the first page; the font size represents their occurrence frequency). The report aims to incorporate and represent the different perspectives from the researchers involved as well as the different domains.

The report is set out as follows:

Section 1 – Research Components: Areas and Levels of Research

In this section, we present a model which conceptualises the research challenges identified in the workshop discussions, organising them into a number of 'areas' of research and 'levels' of intervention, defining the scope of each, and how they relate to each other in terms of an overall 'research lifecycle'.

*Section 2 – Summary of Research Challenges and Goals Identified*

In this section, we summarise the discussions which took place in the workshop. They are grouped thematically, according to the research challenges and goals identified by participants, at each level of intervention, and in relation to the overall 'research lifecycle'.

Section 3 – Outputs of group work: Research Questions Identified, and Ideas for Solutions to Engage People in More Physical Activity

In this section, we present the specific research questions identified during the group activities, the outline concepts which arose from the brainstorming activities to develop ideas for solutions to engage people in physical activity, and some specific research questions that would need to be addressed to develop those concepts further.

SECTION 1 – Research Components: Areas and Levels of Research Identified

Three key areas of research emerged from the thematic analysis: (a) physical activity behaviour, (b) behaviour change techniques and (c) technology. They can be represented as a research 'lifecycle', showing how they relate to each other, and how they relate to two different levels of inquiry: the 'behaviour level' and 'intervention level'.
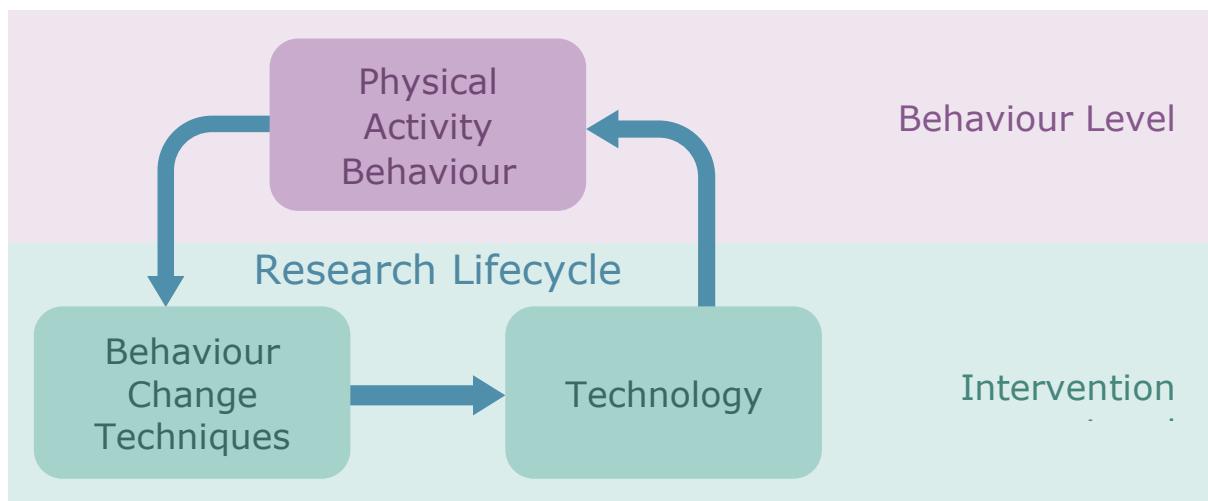
1. Scope of the Research Components

a. Physical Activity Behaviour

Analysing the reasons underlying physical activity behaviour; identifying groups who are priority targets for interventions, based on their current physical activity behaviours.

b. Behaviour Change Techniques

Enabling the target groups to improve and then – if possible – maintain the 'better' behaviour through appropriate behaviour change techniques; either focusing on individual behaviour *directly* or on the *environment* that affects the respective behaviour.

c. Technology

Evaluating what kinds of technologies may be used in a particular intervention, to support behaviour change and achieve GAMO's aim of enabling mobility through the use of digital technology.

2. Scope of the Research Levels

a. Behaviour Level

It is essential to understand *physical activity behaviour* from both a cultural and individual perspective: How do our culture and environment support or impede physical activity? Which factors can be identified that lead to us living a more sedentary life? What motivations do individuals have to be physically (in)active?

b. Intervention Level

Based on the findings at the *behaviour level* concerning factors that support or impede physical activity, *behaviour change techniques* can be selected or elaborated. Work at the intervention level is concerned with questions such as: Should these techniques focus on the environment or the individual? Which type of motivation should the behaviour change technique be based on? What needs to be measured? To what extent can or even must technology be used?

The usability, use and usefulness of the *technology* must all be further evaluated: Does the technology help to change behaviour and establish a lifestyle with increased physical activity? Does it build on the understanding of the roles of both extrinsic and intrinsic motivation in order to support long-term behaviour change? In which circumstances can the role of technology as a 'physical activity motivator' or 'enabler' be reduced or become unnecessary?

c. Research Lifecycle

To address the various research components at the behavioural and intervention levels will demand effective interdisciplinary working & collaboration. In order to achieve this across the *research lifecycle*, we need to understand how the various disciplines can work closely together, establish guidelines, and elaborate and share best practice.

SECTION 2 – Summary of Research Challenges & Goals Identified

The research challenges and goals identified during the group discussions have been grouped thematically, under the different levels of intervention, and in relation to the overall research 'lifecycle'.

1. Behaviour Level Research Themes

1.1 Analysing the Factors Contributing to Sedentary Lifestyles / Physical (In)Activity

Goal/Challenge:

Identifying both environmental and individual factors in sedentary lifestyles and (in)activity as well as the different intrinsic and extrinsic motivations.

Summary of discussion:

The findings would not only allow us to develop evidence-based interventions but could even lead to an *engagement theory*, which may provide a more holistic understanding of physical (in)activity.

Considering further – more general – factors of health and wellbeing that are likely to be related to unfavourable physical activity behaviour could provide a broader and more solid foundation to design interventions (and to develop the engagement theory).

1.2 Cultural and Environmental Factors in Individual Behaviour

Goal/Challenge:

Identifying the external factors leading to unfavourable individual behaviour with the aim to determine target environments for potential interventions in a further step.

Summary of discussion:

The relevance of cultural and environmental factors should be taken into account before considering any intervention focusing on the individual: Firstly, sometimes improving physical activity behaviour by changing the environment (in the illustration represented by arrow 1) has greater potential – in particular for long-term engagement – than trying to change behaviour directly (arrow 2). Secondly, even if an individual intervention was the best approach to change a specific behaviour, it is in most cases beneficial to first understand its cultural and environmental context: Individual behaviour and motivations are often heavily shaped by the environment (e.g. what is considered to be the norm/normal).
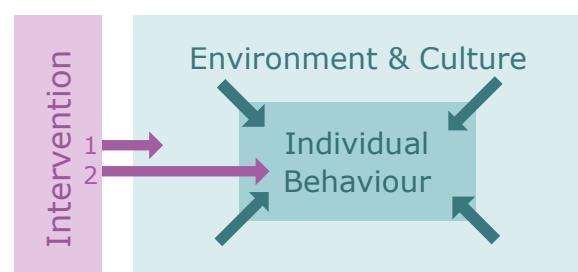
1.3 Individual Factors

Goal/Challenge:

Identifying the individual factors that cause physical (in)activity with the aim to define target populations or groups for potential interventions in a subsequent study.

Summary of discussion:

Individual factors and motivations for physical activity vary significantly. To know or even understand them helps to better tailor interventions to the targeted individuals.

Even if the individual factors are strongly influenced by culture and environment, conceptualising them separately might help to better define and target the interventions.

2. Intervention Level Research Themes

2.1 Designing Tailored Interventions

Goal/Challenge:

Addressing the challenges identified on the cultural and/or individual level through interventions aiming at one or both of these levels.

Summary of discussion:

Interventions must address a real problem or need of a society, community or individual. In general, they should target the people having the greatest 'need' (for higher physical activity). However, even if a clear target population could be defined, there may still be significant differences in the individual motivations (e.g. due to demographic factors). This means interventions should be as 'individualizable' as possible.

Moreover, an intervention must be accessible to a target population, which also means that it should employ, if possible, technology that the population already uses or that can be easily made available to them.

Furthermore, the intervention must take into account the target population's attitude/ openness towards (the specific) technology to prevent resistance and achieve higher satisfaction. For continuous satisfaction and engagement, it is important that the intervention allows users to stay as autonomous as possible and gives them the feeling of agency and self-efficacy.

Even if an intervention aims at individual behaviour, it is essential to also consider the environment: For instance, a specific individual intervention might only be possible in a certain community; or one (social) environment might be more encouraging than another, which may lead to higher engagement in the intervention.

2.2 Cultural and Environmental Interventions

Goal/Challenge:

Improving (individual) behaviour by changing the environment or by helping people to change it.

Summary of discussion:

On the one hand, these interventions could be measures enabling people to *build or create an environment* that better supports or even empowers activity. Such an intervention does not aim for behaviour *change*; it rather makes favourable behaviour *possible,* e.g. by challenging cultural beliefs that prevent people from being active. Community-based programmes (e.g. delivered by trained community members) have the potential to be more effective and durable than services delivered 'top-down' (e.g. by the government).

On the other hand, these interventions could be tools that enable people to *document environmental* factors that impede physical activity (such as the physical environment, industry, law, policymakers). For instance, a web forum on which pictures and descriptions of the environment could be posted, such as details of places where pavements are missing (as an example of an environment that does not support physical activity, i.e. walking). Such solutions could raise public awareness or inform (or even challenge) the government and the policymakers.

2.3 Individual Interventions

Goal/Challenge:

Improving individual behaviour directly.

Summary of discussion:

Interventions should make use of, and be built upon, the motivations of individuals (of a specific population). However, they should also *take into account* the environment(s) the individual is living/working in. Whenever possible, behaviour change techniques should also *make use of* the (people in the) environment, since human interaction and feedback, as well as positive group dynamics, may have a higher impact on individual motivation than interventions focusing only on *'directly'* changing individual behaviour.

For the interventions, or parts of interventions, that need to be supported by technology it is important to not only provide performance metrics but also feedback that builds upon intrinsic motivation – for instance by telling the users that a particular activity might be enjoyable because it suits their interests.

2.4 Measuring the Right Variables and Giving the Right Feedback

Goal/Challenge:

Keeping track of the progress/success of an intervention as a researcher/user.

Summary of discussion:

Most interventions need to *measure* the states of a specific behaviour over time to evaluate the progress. In this context, to get a more comprehensive representation and understanding of physical activity behaviour, not only activity but also *inactivity* should be measured.

Choosing and defining the relevant variables can be challenging: Does the variable measure the actual behaviour or a meaningful proxy variable of the behaviour? Is it easy to measure the variable? Which sensors/devices does it require? Does it produce consistent data? How to handle patchy and incomplete data? How to get outcome data from people who drop out?

It is no less challenging to define rewards and meaningful *metrics* based on these data to give the user feedback on their current behaviour and progress: On the one hand, the metrics should motivate the user, and on the other, they must not reduce the user's understanding of their behaviour to a single variable. In general, the metrics should be related to intrinsic motivations wherever possible.

Technology can already measure physical activity (calories burnt etc.) quite reliably. However, it is often still difficult to evaluate if a specific activity was well performed (e.g. exercises can do harm if not performed in the right way). Such analyses of more complex movement, posture etc. usually require more sophisticated sensors, sensing techniques and algorithms. Therefore, many physical activities still require human evaluation and feedback and technology should only be used where it is meaningful.

2.5 Meaningful Use of Technology

Goal/Challenge:

Using technology in a way that improves the quality, effectiveness, experience and long-term impact of an intervention, while keeping the user autonomy high.

Summary of discussion:

Research should focus on finding out if a technology is needed for a particular intervention and then, if this is the case, for which aspects of the intervention and to what extent it is required.

There are situations in which the factors for inactivity are complex, and it might therefore be difficult to address the problems by means of technology or technology alone. In this case, the intervention could be more effective if provided through a trained coach or mentor, since it might not be possible for technology to make sense of the behaviour or provide the motivation required to enable a change in the behaviour. This, of course, does not mean that such an intervention has to be entirely technology-free: It might consist of a *mix* of technological and face-to-face intervention. The appropriate 'mix' will depend on the evaluation of the trade-off between the higher *scalability and lower costs* that technology may offer vs. the better *individualisation and higher motivation* that a human mentor might provide.

When designing interventions, one of the main challenges is to define the allocation of function between people and technology; not only for the evaluation of physical activity but also for the feedback on it (e.g. feedback from a human is often more rewarding than feedback from a machine). In many cases, a 'hybrid approach' – making use of both (trained) people and technology – might be the most effective and efficient solution.

As soon as technology is involved in an intervention it must, of course, be accessible for the target population: (a) the population should either already use the required technology or it should be easy to make it available for them and (b) they should be capable of using the technology (e.g. limitations due to impairments).

2.6 Establishing Continuous Engagement

Goal:

Enabling ongoing positive physical activity behaviour in the long term.

Summary of discussion:

Due to the novelty effect technology can have, considerations on long-term engagement are especially important for interventions that incorporate and depend on technology: An initial improvement of behaviour might be more related to the excitement about a new technology than to the quality of the overall intervention. A rather obvious way to test this is to not only make use of the latest but rather already-established technologies. The challenge is then to overcome any novelty effect there may be.

The ultimate goal should be in most cases that the target population can *maintain* the better behaviour (in the long-term) without depending on the technology. This may be achieved if the intervention also 'incorporates' / makes use of the environment, for instance by establishing a 'new normal/norm'. Supporting the user's independence could also increase user autonomy as well as the feeling of competence.

A possible approach to support continuous engagement could be to try to design the intervention in a way that technology is only needed to *establish* a positive behaviour but not to *maintain* it: For instance, by helping to make the motivation become intrinsic over time.

3. Research Lifecycle Themes

3.1 Cross-Domain Collaboration

Goal:

Bringing together the wide spectrum of disciplines involved in GAMO.

Summary of discussion:

Various questions need to be answered in order to establish effective and efficient cross-domain collaboration: How to understand one another's perspectives? How to communicate across organisational boundaries and define responsibilities? How to establish efficient (and fast enough) technology evaluation and research processes? How to share and elaborate best practices and frameworks across the domains?

It is also not evident how to compete and collaborate with the commercial sector: Should the researchers focus on the domains that the industry is less interested in? Where is it possible to learn from the industry? What unique contribution can academic researchers make? Where should the industry (and its business models) be challenged?

3.2 Developing Best Practices and Guidelines

Goal/Challenge:

Developing best practices and frameworks across the domains to support efficient and effective collaboration.

Summary of discussion:

Developing best practice approaches could help to enable fast technology evaluation, ethical approval for the use of novel technologies, research designs beyond randomised controlled trials etc.

Making the research process more efficient could also help to address the difficulty of keeping up with the speed of technological advancement. Finding standardised techniques for evaluating interventions would enable better comparison between them, and provide a basis for the development of quality guidelines. Guidelines could also be established for the choice of behaviour change techniques to enable researchers to take well-founded decisions on which techniques to use for a specific problem.

The impact of digital health services and applications should be measured to identify those that do not help or may even do harm. Evidence generated by this analysis might be used to inform decisions (e.g. of policymakers) about the provision of services; it may also allow setting up health technology assessment guidelines (including usability studies).

4. Summary & Outlook

This report represents the output of the workshops of GAMO's first symposium held in May 2017. The key research challenges we propose are the result of a thematic analysis of individual workshop notes. On the basis of these challenges a simple research lifecycle model has been outlined that comprises three main research components: (1) the analysis of physical activity behaviour of specific target groups, (2) definition of adequate behaviour change techniques based on the preceding analysis and (3) the selection of appropriate technology to be used in the behaviour change intervention.

The most recurring challenges in the thematic analysis were: (a) the relevance of the (sociocultural) environment in the design of the intervention especially in regards to development of more favourable social norms (b) the meaningful use of technology concerning the availability and accessibility for the target group and its capability to trigger (intrinsic) motivation (c) how activity is being measured and feedback is provided (d) the cross-domain collaboration as a challenge in itself and the need for best practices and frameworks to support effective collaboration.

By laying out these, more general, research challenges and goals of enabling movement, the main purpose of this report is to provide a basis for the research roadmap.

SECTION 3 – Outputs of Group Work: Specific Research Questions Identified, and Ideas for Solutions to Engage People in More Physical Activity

1. Research questions arising from workshop discussion on research challenges relating to use of digital technologies to motivate, enable and support physical activity

Questions are sorted by core topic.

Questions	Topics	Core topic
How can we design cheap, simple and effective (scalable) solutions that everyone, independent of income, can embrace and incorporate in daily life?	Meaningful use of technology Accessibility Cost-efficiency Incorporating in daily life	Accessibility
We all need to work together from different disciplines to understand and develop the field and create a wider impact. How can we collaborate better across domains?	Collaboration across domains & agendas Tailored interventions	Collaboration across domains & agendas
How can we work together and collaborate in a way which enables us to compete with the commercial sector, often better funded and with huge teams behind innovations?	Collaboration across domains & agendas Competing with commercial sector	Collaboration across domains & agendas
Are we just playing with technology? How can we bring different people with different agendas together in research to actually think about using technology to create impact?	Meaningful use of technology Collaboration across domains & agendas Tailored interventions	Collaboration across domains & agendas

How can we work across domains to develop an interdisciplinary approach to understanding inactivity behaviour? Can we look beyond behaviour change theory & methodologies to help us understand personal behaviour more broadly – is it about more than motivation? What should the metrics be?	Interdisciplinary working Collaboration across domains & agendas Find reasons for inactivity Cultural & environmental factors Social & cultural factors Behaviour change How to measure / data quality	Collaboration across domains & agendas
How can we share best practice in study design involving new technologies which may, for example raise new ethical issues?	Collaboration across domains & agendas Research methodologies Fast evaluation of new tech	Collaboration across domains & agendas
The concept of 'intervention' suggests we have a choice to behave differently but we don't always e.g. the built environment may prevent or mitigate against activity. Can technology alone fix what the built environment prevents? How can a consideration of environmental and cultural factors (e.g. how we structure working days) help us to address what technology can't, and get the best from technology?	Cultural & environmental factors Meaningful use of technology	Cultural & environmental factors
Can we use technology to document what the environment is like? We need to know: Is the availability & pull of "unhealthy" options stronger than the potential of tech to "save us from ourselves"? Who should we be shaming – people themselves, or the built environment, industry, policymakers, employers (e.g. lack of cycle paths, lack of sidewalks, jobs designed to be sedentary)? Can we develop technology to empower citizens to document issues which prevent activity (e.g. environmental factors), to inform and challenge policymakers?	Documenting environment Cultural & environmental factors Increasing public awareness Inform policymakers Meaningful use of technology	Cultural & environmental factors
How can we use tech to support an "exerciseogenic" or "activityogenic" environment?	Cultural & environmental factors Goal of phasing out tech	Cultural & environmental factors

Very often there are cultural factors for de-motivation. Can technology help reshape cultural beliefs that prevent people from being active?	Engaging communities Cultural & environmental factors Achieve (intrinsic) motivation	Cultural & environmental factors
How do we target and engage the "unengaged" / "unmotivated" inactive rather than making the people who are already active, more active?	Tailored interventions Engagement	Engagement
Much research focuses on the effectiveness of interventions (and rightly so) but we need also to consider how to build theory about engagement. How do we actually engage people in interventions?	Need for an engagement theory Engagement	Engagement
How can we make community-based interventions sustainable? Do we need to think more about how we might work with members of the community, rather than having an organization / institute / government struggling to sustain a service to keep people active?	Engaging communities Sustainability	Engagement
What can we learn from industry and the commercial sector? They are good at marketing these things (even if they don't work). Is it possible to engage more with industry? Do we need more funding to support marketing and promotion of effective interventions (developed by academics)?	Engaging with industry Learn from the industry	Engagement
Can we measure the negative impact of technologies (devices and apps) that do not work or do harm? How can we develop the evidence we need to set standards and guidelines for health technology assessment (which should include usability studies)?	Meaningful use of technology Methodology & data quality Inform policymakers Health tech assessment & guidelines	Health tech assessment & guidelines
How can we ensure that technologies are designed to meet real needs and make a real difference to people's health, rather than 'needs' being created *post hoc* by marketing, to sell a product that has already been developed (as may be the case in a purely commercial approach)?	Meaningful use of technology Fast evaluation of new tech	Meaningful use of technology
Can we think more imaginatively about how to use tech to transform health? Should we be using tech to educate people about what a "better normal" could look like, including a better environment that encourages and enables more activity, rather than focusing on yet another app?	Cultural & environmental factors Challenge the norm	Meaningful use of technology

How can we develop new approaches for faster evaluation of new technologies so that the technologies are not already out of date when the findings are published?	Fast evaluation of new tech Methodology & data quality	Methodology & data quality
How do we address data quality issues and determine actual behaviour based on patchy, incomplete and implicit data?	Methodology & data quality	Methodology & data quality
How do we overcome the limitations of the RCT? Is that the best way to evaluate activity interventions? Is it flexible enough to show whether an intervention is effective? For whom? When? Under what circumstances? How can individually tailored interventions be robustly evaluated? Do we need new methodologies apart from RCTs?	Research methodologies Methodology & data quality Tailored interventions	Methodology & data quality
How can we make better use of AI to make studies scalable and enable us to better detect effects (so we can demonstrate greater effect sizes when they are there), and better control experimental studies?	Methodology & data quality How to measure / data quality	Methodology & data quality
How do we get outcome data from people who drop out of studies?	Methodology & data quality How to measure / data quality	Methodology & data quality
Technology tends to focus on extrinsic motivation. Can we use technology to promote intrinsic motivation such as measuring subjective 'goodness' of exercise (e.g. "I had a great run") and use this to encourage more exercise and enhance positive experience (e.g. "Do this, it'll be fun).	Motivation & behaviour change Achieve (intrinsic) motivation	Motivation & behaviour change
How can we incorporate behaviour change techniques in technologies and interventions without leaving users feeling they have a lack of control and/or triggering reactance/resistance?	Motivation & behaviour change Tailored interventions Preventing reactance Support feeling of competence	Motivation & behaviour change
How does the relationship between motivation and behaviour vary from individual to individual, or across demographic groups?	Motivation & behaviour change Achieve (intrinsic) motivation Tailored interventions Social & cultural factors	Motivation & behaviour change

How do we connect various measures of motivation to an individual's intrinsic motivation to create actual behaviour change?	Motivation & behaviour change Achieve (intrinsic) motivation Addressing individual goals	Motivation & behaviour change
Do our interventions take account of user agency to make them autonomous and feel competent?	Motivation & behaviour change Support user autonomy Support feeling of competence	Motivation & behaviour change
What is the relationship between motivation, encouragement/feedback and long-term engagement in interventions and activity behaviour change?	Motivation & behaviour change Addressing individual goals Sustainability	Motivation & behaviour change
What is the motivation for long term use of apps/wearables and other activity technologies?	Motivation & behaviour change Sustainability	Motivation & behaviour change
We need to learn more and provide better guidance on which and how many behaviour change techniques to include in apps. Surely it can't just be 'more is better'? So which ones? In what combinations?	Motivation & behaviour change Tailored interventions	Motivation & behaviour change
Should our goal be to phase out tech? How can we support this process (e.g. enabling users to develop new habits that they can sustain without ongoing use of technologies)?	Motivation & behaviour change Meaningful use of technology Goal of phasing out tech Support user autonomy Support feeling of competence	Motivation & behaviour change
Do we really understand why people are inactive? Should we be studying instances and motivations for **in**activity rather than just focusing on promoting activity?	Motivation & behaviour change Find reasons for inactivity	Motivation & behaviour change
How do we overcome the novelty effect and maintain sustainable engagement with technologies?	Motivation & behaviour change Sustainability	Motivation & behaviour change
We need to think more about rewards. What is a reward for users (from their point of view)? How is that reward expected to be delivered? Rather than just + or – rewards, can there be a "fuller" reward delivered via tech?	Motivation & behaviour change Tailored interventions Addressing individual goals	Tailored interventions

How about matching users with a physical activity mentor who can understand the more complex reasons behind the lack of physical activity? How might technology help the mentor to enable an effective intervention rather than expecting specific tech to perform "miracles" on its own with just the individual?	Tailored interventions Addressing individual goals Engaging communities Engagement	Tailored interventions
What works for one person won't work for someone else. Everyone is different. How do we design for individual difference, and incorporate solutions for this into apps, wearables and other technologies?	Tailored interventions Addressing individual goals	Tailored interventions

2. Concepts and research questions arising from group work to develop ideas for solutions to engage people in physical activity

Proposed target group	Is this GAMO target group?	Concept	Research questions	Relevant sections in the report & topics
Children/young people	Yes	Co-creation of active teaching using existing school technology • Facilitating sessions with pupils, teachers & parents • How to use existing tech to make it active • Could be primary/secondary school • Cross-curricular potential (re national curriculum)	How can school classes be more physically active? How can existing technology (of schools) be used to support higher physical activity? Is it possible to improve the engagement in schools using a co-creational approach getting teachers, parents and pupils involved?	Behaviour & intervention level (cultural/environmental) Intervention level (Meaningful use of technology) Intervention level / Research Lifecycle (Designing tailored interventions)
People with anxiety	Yes, in specific settings: adults in workplaces; older adults, especially in elder-care settings	App giving route and place suggestion • Encouraging those with anxiety to safely explore • Use social beacons encourage people to approach them • Adapt route based on personal history & preferences	How can technology help people with anxiety get more active? Can an app with route & place (for activity) suggestions based on personal preferences help people with anxiety be more physically active? What role could crowd-sourcing play in developing this?	Intervention level (Individual as well as cultural & environmental interventions) Designing tailored interventions Measuring & feedback Intervention level (Individual level)

Proposed target group	Is this GAMO target group?	Concept	Research questions	Relevant sections in the report & topics
Adults (in workplaces and/or older adults)	Yes	Smartphone assistant to reduce sedentarism • Smartphone: "I've been sitting a lot." • Effect on user: "Alright, a short break from sitting should be OK…"	Can movement & position data (from smartphones) in combination with notifications/feedback lead to better physical activity behaviour (e.g. less sedentarism)?	Intervention level (Individual interventions) Designing tailored interventions Measuring & feedback Meaningful use of technology
			Can physical activity assistants/mentors (using conversational interfaces) improve physical activity behaviour (more than traditional behaviour change techniques)?	Intervention level (Individual interventions) Designing tailored interventions Meaningful use of technology
			Do context- and time-specific notifications/reminders have a bigger impact on physical activity behaviour than notifications not related to context and time?	Intervention level (Individual interventions) Designing tailored interventions Measuring & feedback Meaningful use of technology
Adults (older adults)	Yes	Technology to promote social interactions of seniors and hence physical activity	Can technology promote social interactions of seniors? If yes: Can it promote exercise? Can it reduce loneliness? Does it have a positive effect on cognitive functions? How might this work? What kind of technology?	Intervention level (Individual as well as cultural & environmental interventions)

Proposed target group	Is this GAMO target group?	Concept	Research questions	Relevant sections in the report & topics
Adults (older adults)	Yes	Technologies to promote confidence and pleasure • Gardening for older adults • Playing & composing music • Cooking • Chores	Can technology have a positive impact on confidence and pleasure? Does confidence and pleasure have a positive impact on physical activity behaviour? Which are activities that support confidence and pleasure?	Behaviour level (Cultural & individual factors) Meaningful use of technology
Children	Yes	Better understand children's use of: • Social media • Digital screen time	How & why is technology making children sedentary?	Behaviour level (Cultural & individual factors) Meaningful use of technology
Adults	Yes, in specific settings: adults in workplaces; older adults, especially in elder-care settings	Build a 'Garry' • Garry tells me to exercise and it's a good thing (not like persuasive tech)	Does playful / humanoid / conversational information / notification / feedback have a greater impact on the actual change in behaviour than the traditional 'channels' / ways to notify and inform people?	Intervention level (Individual interventions) Designing tailored interventions
Adults (older adults)	Yes	Hacking radios for activity • Setting: older person, sedentary, habitual radio listener • Trusted friend or relative records activity encouragement to tie listening behaviour to activity behaviours e.g. "I'll listen to x, then I will walk	How can existing technology of seniors be used to encourage activity? What role do friends / relatives / people in environment play in encouraging activity? Can radios (listening behaviour) be hacked to help seniors develop new habits / support seniors being more physically active?	Designing tailored interventions Meaningful use of technology