

Intergenerational connectivity for promoting health and well-being across ages, places and spaces

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Introduction: healthy ageing in an increasingly digital world

The expanding digitalisation of everyday life that has occurred over the past 30 years has affected all segments of society from youngest to oldest. Digital connectivity—connectedness through digital technology—is recognised as having growing importance in linking individuals to community, information and other resources. It increasingly mediates connections to material and virtual supports that are relevant to healthy ageing and reducing health inequalities in later life (De Santis et al, 2023). Xu et al (2021) highlight the implications of this trend as meaning that ‘digital technology will continue to shape the way we access health information, connect with loved ones, and stay active’ to the extent that ‘digital access has become a new social determinant of health’ (p134). Developments in eHealth promotion (Muellmann et al, 2018), for example, highlight the potential of digital applications to support those living with long-term conditions and improving and maintaining their health and well-being. Evidence is also emerging of the potential benefits of digital applications such as videogames for health on physical, cognitive and social aspects of adult, including older adult, users’ health-related quality of life (Marston and Hall, 2016).

The potential of digital tools and technologies to maintain and promote health, well-being and social connections in later life was dramatically highlighted by the COVID-19 pandemic. In countries such as the United Kingdom, restrictions on movement and in-person interaction prompted many older adults to adopt new strategies, including technology use, to maintain social ties. Emerging evidence on the impact of the pandemic on older people’s use of digital resources across different countries presents a mixed picture in terms of the levels of uptake of different digital technologies

(Heponiemi et al, 2022; Balki et al, 2023), as might be expected given variation in economic, policy and cultural responses to the pandemic. In terms of the perceived benefits of technology during the pandemic, a nationally representative survey of Canadian older adults found that among those aged 65+ digital technology users endorsed a range of benefits in terms of supporting health, wellness and communication (Sixsmith et al, 2022). Specifically in a survey in Scotland, some older adults reported moving their typical physical and social activities to digital platform versions of these due to the pandemic physical restrictions of lockdown and social distancing (Tomaz et al, 2021; 2022). Importantly, those who were able to maintain moderate or high levels of physical activity also reported higher health-related quality of life, similarly those maintaining more social contact reported less loneliness (Tomaz et al, 2021). Positively, digital technologies to promote or sustain physical activity have the potential to reach populations who may have difficulties accessing traditional physical activity interventions (Norman et al, 2007). This can include institutionalised older adults such as those residing in care homes, and there is some review evidence that such interventions can be effective for and acceptable to these older adults (Dawson et al, 2024).

Even in countries where access to infrastructure and digital devices is relatively high and demographic changes leading to population ageing are highlighting its public as well as its personal importance, there is a long way to go in fully realising the potential of digital technology to support 'healthy ageing'. Despite the growing landscape of digital technologies for health promotion with older adults, much of the research conducted to date on the impact of these developments has tended to focus on independently living older people in non-institutional settings with higher levels of income, education and self-reported digital competence (De Santis et al, 2023). There are also practical barriers to the development of digital products and services which might aid healthy ageing. For example, there is a pressing need to understand and incorporate older individuals' requirements and preferences to support more widespread adoption of digital health technology by this population (Henson et al, 2023), but the skills required and costs of doing so in a systematic way can be prohibitive, especially for smaller developers.

This push towards using technology as an alternative means of maintaining physical and social activity directly fitted into the purpose of the UKRI Healthy Ageing Challenge's Social, Behavioural and Design Research Programme (SBDRP). The GOALD (Generating Older Active Lives Digitally) project, the subject of this chapter, was a three-year research collaboration between the University of Stirling and the University of Plymouth's Centre for Health Technology. It sought to address identified research gaps, connect technology developers with older people to design, test, deliver and evaluate digital resources for health, well-being and social connectedness in older age. It also aimed to work with stakeholders to

produce outputs to inform the development of future products and services. The project additionally sought to address the continuing disparities in health-related experiences of later life through targeted interventions and technological applications designed to connect older people with communities and resources for health improvement.

Aims and methods

The aims of GOALD were: to develop and determine the feasibility and acceptability of co-designed digital tools for promoting healthy ageing, facilitating structured activity programmes in two areas—physical activity and sport-based reminiscence; and to demonstrate opportunities for the development of related products and services to enhance supports for healthy ageing and inform future development.

The GOALD project employed a ‘co-production’ approach (Hennessy *et al*, 2023). Inclusive approaches to developing technologies with older users have gained momentum in recent years as the benefits of product and service design and development directly informed by user experiences have become increasingly apparent (Östlund, 2015). To pursue GOALD’s aims, the research team worked with stakeholder organisations and groups of older people. Ten national, regional and local non-academic partner organisations helped to recruit and engage geographically, socio-demographically and functionally diverse older participants from community-based and residential care settings in Scotland and southwest England (Devon and Cornwall) in the co-production process. For example, two partner organisations, iSight Cornwall and Hearing Loss Cornwall, assisted GOALD in addressing the digital requirements of individuals with visual or hearing impairment.

In collaboration with partner organisations, GOALD recruited an intergenerational advisory group. Members ranged in age from 32 to 79 years and comprised 28 individuals with experience of working with older people across health, well-being and social contexts. Tasked with identifying and exploring factors which facilitate or hinder older people’s digital resource use, the advisory group met between October 2021 and March 2022. Their discussions informed the range of technologies that GOALD tested, the ways in which these were offered to and tried out by participants, and measures employed to capture existing physical activity and use of digital technology.

GOALD’s partner organisations also assisted with the recruitment of 184 individuals who joined the project’s co-production groups. Across the GOALD project, participants included 145 older adults (aged 60+), six younger people (aged 16–25) and 33 health and social care professionals in roles which support or work with care home or community-based older people. GOALD’s original intention of achieving broad intergenerational

participation by including high school students in the project was not realised due to the impact of COVID-19 restrictions during recruitment (Tomaz et al, 2024). In total, seven care homes and 11 community groups participated in the project, although due to the geographical logistics of the project, not every case site included every element of technology that the GOALD project assessed.

The co-production group meetings took place in person or online, typically bi-weekly for up to six months. Participants were introduced to a range of digital technologies (from a menu of 20 options) including, for example, virtual reality (VR), AI voice technology, mobile applications and physical activity websites. They were asked to offer their views and preferences on which they were interested in trying out. Participants then engaged in sessions where they had the opportunity to use the selected technologies and provide feedback on their experiences. Following these sessions, participants took part in further formal evaluation focus groups designed to elicit: their reactions to the technology; their motivations for use; their perceptions of potential benefits and barriers to use of the trialled technologies; and their suggestions for improvements. Finally, in a series of ‘creative co-design workshops’, older participants ranked their priorities for these technologies and contributed ideas for future technology-enabled products and services.

Qualitative and quantitative data from the co-production group discussions and workshops, ranking exercises, interviews and group observations were collected and analysed using thematic analysis and descriptive statistics. Findings were used to develop ‘toolkits’ which distilled what was learned from GOALD activities for future use by digital designers and developers (Veliz-Reyes et al, 2024). Ten of GOALD’s business collaborators, UK-based small and medium enterprises (SMEs) producing digital technology, then used the initial versions of the ‘toolkits’ to create new/adapted digital resources for health promotion geared to older adults. In the final project phase, through a survey and in-person interviews, the participating businesses offered their views of the co-production process results, with a final combined version of the ‘toolkit’ incorporating feedback and insights from this process.

Findings

Findings from GOALD provide insights into four areas: 1) digital health technology to promote and/or sustain physical activity; 2) digital health technology in supporting structured reminiscence activity; 3) the functionality of digital health technology; and 4) the impact of co-design for digital technology developers. Here we provide an overview of key findings in each area. Other GOALD project outputs provide more detailed discussions of findings in the cited references. The learning synthesised from

findings across GOALD and the overall implications of the findings for policy and practice are presented and discussed later in this chapter.

Sustaining physical activity

Our overarching finding is that, despite some initial trepidation, digital technology can play a role in providing structured physical activity for older adults. This would be particularly as a prompt, resource or support for activity for less active individuals, and through providing ‘off the shelf’ activities for carers to use with older adults (Tomaz et al, under review). GOALD participants with access to in-person classes did not see digital technology-based physical activity as equivalent, or superior, to physical activity delivered in person. Rather it was viewed as another opportunity to engage in being active or something which could enhance in-person offerings or be used on its own. Participants viewed their motivation to engage with digital technology as centring around its potential to be a source of social activity and fun; extrinsic rewards like score boards, and external prompts which can be provided through digital technologies, were seen as opportunities to help improve engagement levels. For example, games with an element of competition were seen both as fun and useful, as this distracted from the fact that they were exercising. Further, technologies which incorporated group activity were seen as highly beneficial, as noted by several participants: “You’ll get the company; you’ll get the exercise and you do your exercise better when there’s a group of you.”

Participants saw the potential for a range of valued and valuable outcomes from engaging with digital technology, including physical benefits and cognitive aspects. For example, participants noted that many of the technologies kept them moving but also “keep your brain active”. They also valued the range of ability levels considered in some technologies, for example, providing both seated and standing exercises so that people with difficulties with leg movements could still take part to maintain their current physical activity levels and ability, but also build up confidence in those concerned about their balance or abilities. Participants noted physical benefits which would lead to further independence, for example a care home resident noted:

all these muscles you’re building up will help you to push yourself up. All these arm ones for getting out of your chair. Especially you [name], for getting out of your chair, all these arm ones keep you a wee bit more mobile. Keep you on the dance floor. You can get from A to B on your own.

While such benefits are seen as potentially realisable by most older users of digital technologies, barriers to their realisation in practice do exist and need

to be considered and addressed for health-promoting digital technology to have maximal impact. For example, older adults with physical and cognitive limiting conditions may be unable to engage at all with some existing digital technologies. For instance, those in wheelchairs will struggle to participate in some digital games or activities based on or requiring lower limb movement, although some developers had incorporated design elements which would still allow some level of engagement while seated. Further, people with sight or cognitive impairments struggled to engage with technologies where the physical activity was delivered mainly on a screen with visual demonstrations of exercises, which underlined the need for clear audio instructions to accompany the visual, or for in-person support alongside technology use. For example, community group members mentioned that the avatar and written instructions for one piece of technology for aqua aerobics was, for them, "... too small to see, needs audio read out of what to do as well as the demo."

GOALD participants also raised concerns around safety, accessibility of technology and the availability of appropriate space for the technology to be used to its fullest potential. Issues with WiFi speed, access to large enough screens for content to be visible, and space, particularly within care homes to house equipment or to exercise, were acknowledged:

The thing that gets me, a lot of people do these on an iPad or a small-screen computer, instead of getting it onto the TV screen and being able to watch it in the lounge. Now, if you could make that a bit easier for them, how to do it, if you like, I think that would help.

Further, many care homes have wing-back chairs in their communal living spaces, but these can interfere with the execution of physical movements that the technologies are promoting. Care home-based participants noted that more upright chairs, even with arms, were better if people needed them to get onto their feet: "You're actually better on something like this, or the dining chair or the ones with arms."

Findings from GOALD also suggest that digital health technologies that seek to be sources of structured physical activity for older adults must consider the suitability of activity. GOALD participants felt that the most successful digital technologies for promoting healthy ageing in older populations would be those which provide and allow participants to choose from a variety of relatable content as well as allowing users to control the type, duration and intensity of activities: "Here, you can have a lot of different programmes that can stimulate different people in different ways. It could be used for calming, it could be used for more exercise-based. You could have games, you can have music in the background. It's adaptable."

Such technologies could provide tailored experiences to suit the needs and likes of a diverse older population. Further, GOALD participants identified

the reliability of digital content, regardless of how it was delivered (for example, via video, live sessions or gamification of activities), the clarity of demonstrations and instructions for using digital technologies, and the need for an engaging approach as critical factors in motivating continued engagement over time from older users. Recommendations included incorporating demonstrators of a similar age to the intended end-users rather than featuring only younger people or young avatars to enhance confidence and motivation, for example:

I think that's important, because you want to be able to see that somebody like you can do it. If you see a really fit man doing it, and then you think, "Oh, well I can't do that because they're able to do it, but I'm a less fit woman," you might say, so you're not able to do that. But seeing someone like you doing it makes you feel more confident.

Reminiscence activity support

Similar to prior research in this area (Tolson and Schofield, 2012), GOALD found that older people's 'connectivities', their links with community, resources and meaningful activities such as heritage experiences, are essential contributors to health and well-being. Adding to that research, GOALD found that the use of digital resources, including live video streaming, themed short-form-video and the use of digital archives, as memory triggers in the delivery of sport-based reminiscence to community groups, enhanced participant experience of this activity (Haynes et al, 2023).

GOALD found that the social dimensions of group-based reminiscence activities and the familiar locations in which community sport-based reminiscence groups were often held enhanced participant experience. Researchers observed sense of belonging and camaraderie between participants, which participants confirmed in small-group interviews, a common response being: "It's the friendship and reviving old memories."

Another key dimension of the sport reminiscence meetings was their regularity in the calendar, with groups often meeting at the same time and on the same day of the week on a pre-scheduled basis. A key feature of the regularity of meetings, often at sport clubs, was the motivation to attend to avoid social isolation: "If I didn't come here I'd just be sitting at home reading the paper."

Two of the co-production groups in GOALD also combined reminiscence sessions with physical activity. For one football-based reminiscence group this included participating in a game of walking football immediately following the memories session. For another, indoor games, such as carpet bowls or adapted games with beanbags, were integrated into reminiscence sessions. One conclusion from such integrated activities is that the social dimension

of such groups is a key motivator for attendance, and the regularity of such meetings also helps structure older people's calendars as motivators to leave the house and engage with others.

The GOALD study explored the potential for using off-the-shelf technologies for remotely streamed video access to sporting heritage sites as part of structured sport-based reminiscence activities for older people in three different community contexts. The researchers remotely streamed from five different sporting heritage locations including a football museum, a public statue, the archaeological sites of former football stadia, a motorsport museum and a national rugby stadium tour. Such live-stream heritage visits require prior research to make heritage content intelligible and engaging. They also require stable internet connectivity at the heritage site and the receiving community context and contingency for when connectivity gets lost.

The key findings from live-streaming during the GOALD project established that remote access to sites of sporting heritage can trigger personal memories of sport, creating forms of nostalgia, pleasures of experiencing both the familiar and the unknown, and social connectivity between sport reminiscence participants. For example, following a visit to the statue of the former Celtic and Scotland international Billy McNeil in the small town of Bellshill, respondents immediately created episodic memories of the player and an era of football with which they identified. As one respondent noted: "We became engrossed in the Billy McNeill thing ... it was very interesting as we all knew a lot of the things Billy had done."

As the engagement and trust with the community groups in GOALD developed, the project was able to respond to requests to explore new heritage sites and themes in an iterative process. Groups expressed preference for themed sport reminiscence delivered in person and incorporating digital content—such as short-form video content including well-known former sports people—which stimulated engagement in new ways. The researchers heard on numerous occasions how the blend of digital content with material heritage enhanced the experience, with comments like "It's totally changed their approach to it". Nevertheless, while participants viewed digital archive material as supporting the themed approach, there was a preference for tangible heritage materials, such as photographs and sporting ephemera, to also be available. So while digital content as part of themed reminiscence sessions "made technology a bit less daunting", there was also a sense that "having the activity in the room" was preferable, or as one respondent put it "It's better because there's no delay" compared to streaming or learning to access the internet. This was partially due to perpetuating fears among some older people in the groups of using digital technologies to access content. The GOALD co-production groups demonstrated that it is possible to deliver remote and in-person digital access to sporting heritage using relatively readily accessible and affordable technologies such as smart phones and smart

TVs. GOALD findings highlight the need for digital devices and technologies to be adaptable to the context of delivery for community sport reminiscence sessions, for example, being able to access the internet and stream live and recorded media from reminiscence session locations when required, and to be accessible to and appropriately featured for participant inclusivity given the potential socio-economic, cultural, physical and cognitive diversity within reminiscence groups. GOALD found that realising the full potential for digital technology to enhance reminiscence requires novel partnerships, willingness and ability to invest time, and confidence in the reliability of supporting infrastructure. Creating remotely streamed or digitally themed sport-reminiscence experiences requires detailed planning and collaboration between heritage professionals who deliver live streams and facilitators of community reminiscence sessions. To thrive, these partnerships require a supportive digital environment. For example, unstable internet connectivity at either end of the live stream can be a major barrier both to delivery during sessions and willingness to commit to producing and incorporating future digital content.

Functionality of digital health promotion tools

GOALD findings confirmed that even where developers recognised the importance and benefits of working with older people to develop services and products aimed at older users, they did not necessarily have access to the time, financial or knowledge-based resources to do so themselves (Bradwell et al, 2023). GOALD established both demand for and a perception of the usefulness of a ‘toolkit’ designed to disseminate GOALD findings to developers, researchers and other stakeholders interested in the creation of technologies for older people, with a focus on promoting physical activity. Although a planned GOALD core output from its inception, findings from co-production activities across the GOALD project were instrumental in shaping the form and content of the toolkit.

A full thematic analysis of technology interactions with GOALD participants, focus groups and formal co-design workshops suggested that the toolkit should address three core themes: 1) general recommendations for technologies for older adults, 2) physical activity technologies (including websites, apps, games, etc.) and 3) VR for those working with immersive technologies. Accordingly, the toolkit contains three sections. Each section addresses one of the identified themes, collating and synthesising findings from across the project into recommendations and providing GOALD participants’ priority rankings for each recommendation to support developers in exploring the importance of design features to end-users.

Both the final version of the GOALD toolkit and detailed findings which informed its recommendations can be found on the GOALD website

(<https://www.plymouth.ac.uk/research/centre-for-health-technology/goald/toolkit>). The toolkit includes both general recommendations and those specific to particular technology types, with recommendations covering considerations such as ways to encourage motivation for physical activity through technology use, content that end-users wanted to see, hardware-related design considerations and modes of interaction that developers of future products and services might usefully consider.

GOALD found that developers had sometimes given more thought to ideas for a new digital product or service than to whom it might be most suited or how to access those segments of the market. Accordingly, the toolkit incorporates guidance on potential audiences that may be able to use new developments, and suggestions on introducing technologies to different target market groups. GOALD findings on barriers to using the technologies evaluated during the project and suggestions on innovating for inclusivity are also included in the toolkit.

The toolkit also provides details on GOALD's co-design methodology, discussion of the importance of engaging in end-user feedback throughout the innovation process, an overview of the technologies demonstrated to our participants and case studies on how the GOALD toolkit has been used by SMEs and organisations. By including this information, GOALD hopes to help developers to understand the value of engaging in co-design processes and support developers, particularly SMEs, to engage in their own co-design process in the future.

Impact of co-design for digital technology developers

GOALD project activities found that a toolkit which synthesised its findings to produce more general recommendations could be of immediate practical use to developers of digital products and services aimed at supporting healthy ageing for older users ([The GOALD Project, 2024](#)). Many projects create resources which they hope will benefit different groups, but not all have the opportunity to evaluate that benefit. GOALD built the opportunity to test its toolkit in the 'real world' into the project. In order to measure the impact of the toolkit and to ensure the information was presented effectively to developers, the GOALD project hosted a challenge fund competition calling for developers to incorporate feedback from the toolkit into current products or create a new product based on the recommendations. SMEs and organisations within the GOALD network were invited to apply for one of ten £5000 pots of funding. Successful applicants were generally those who could demonstrate specifically how they would apply the toolkit recommendations into their improved or new product. Examples of the developments produced based on the toolkit included creating a way of tracking the level of physical activity completed within VR, increasing the

usability and inclusivity of a physical activity platform website, developing an app to promote intergenerational connectivity and the creation of guides for carers to use a VR product.

GOALD found that insights provided by involvement in research and supplying appropriately tailored resources can lead to the adoption of new practices in digital technology development processes and ultimately to products and services that are more inclusive and fit for purpose. Interviews were held with each winning developer to understand the impact the toolkit had on their products, how they used the toolkits, challenges they faced and suggestions to improve the toolkits. The organisations commented on how the toolkits were useful in validating their products, including to potential investors and funders, and offered a wealth of information to speed up the development of products. For some organisations it provided them with new ideas, and for others it altered their development priorities to better reflect end-user requirements. One organisation, for example, that offered a subscription-based web platform for delivery of online pre-recorded music and movement videos, commented on the outcomes of using the toolkit to redevelop their existing web-based platforms: “An enhanced user experience has positively impacted sales and subscription rates. The clearer, more accessible presentation of our resources has led to a higher conversion rate to ongoing subscription. The GOALD toolkit has proven to be an invaluable resource for our development process.”

All organisations expressed the usefulness of the toolkits, regardless of the stage of development, and were motivated to continue engaging in the co-design practices. Challenges around time to develop and access to funding were discussed as barriers. Bringing GOALD findings directly to business partners and providing co-design input directly from end-users was one of the key goals and successes of the GOALD project. Many industries, particularly smaller developers, find the skills and costs required to systematically engage with older users to be prohibitive at the design stage for their products. The co-design and the testing of technologies with older people and resulting GOALD toolkit provide a legacy of recommendations for future technology developments that businesses can use. Engaging directly with businesses to incorporate GOALD recommendations into further and new technology development has enabled us to evaluate and therefore claim real-world impact of our project findings for industry partners. We recommend that any business looking to focus products on the health and well-being of older adults utilise the GOALD findings distilled into the toolkit to inform their technology development. The toolkit cannot cover all aspects of every potential future technology, which highlights the importance of business, academics and older people continuing to work together to co-design new health technologies.

Implications and conclusion

Promoting ‘healthy ageing’ for all is both an international ambition and, in the UK, a national priority articulated through initiatives such as the Healthy Ageing Challenge. GOALD has provided evidence of the potential of digital technologies to support older users’ health and well-being both through directly provided digital services or content and through the use of digital resources to enhance existing in-person experiences. In partnership with community organisations, older participants and technology developers, GOALD explored the development and use of digital technologies in the contexts of promoting and sustaining physical activity and of sports-based reminiscence. In both contexts, older participants were found to be interested in exploring digital products and services, welcomed opportunities to experience unfamiliar technologies and perceived potential benefits from continued engagement with them.

Equally, GOALD has provided evidence that barriers remain to realising the full potential of digital technologies to support healthy ageing. For example, GOALD found disconnects between developers and the potential users of, and markets for, their digital products and services. Economic and time-related resource constraints on both developers and potential users in some cases led to suboptimal knowledge of older users’ needs and preferences for technology. GOALD found issues with availability of public and community-run spaces with reliable digital service provision to support technology-enhanced in-person group activities. Creating an environment which nurtures and sustains the willingness of organisations and individuals to invest their own time and resources in producing and delivering digital content is critical to realising the potential of digital technologies to support healthy ageing.

In responding to needs identified through the GOALD project by creating a ‘toolkit for developers’ in collaboration with its community and business research partners and participants, GOALD provided compelling evidence of the commercial and wider societal benefits to be gained from partnership working between businesses and academia. Informed by older participant feedback on GOALD-tested technologies and refined after ‘real-world’ use by GOALD’s partner SMEs, the ‘GOALD toolkit’ provides a legacy resource both to inform future developers and to support and encourage them to engage in future co-design processes to help enhance the inclusivity, acceptability and, ultimately, commercial viability of their digital products and services.

Businesses without the skills and resources to do so themselves have been able to leverage academic expertise and experience in accessing groups of older people, working with diverse populations and analysing data from user-engaged co-production to improve their digital products. GOALD research findings have informed the development of a toolkit and illuminated some of

the wider challenges to successful development of digital resources to support older people's health and well-being, including lack of access and opportunities for digital education. Policy makers must continue to work towards reducing digital inequality and increasing digital literacy across all of society. GOALD has used the findings from co-production activities based around specific digital resources to produce 'toolkits' that can guide the designers and developers of future generations of digital products and services targeting ageing populations. These toolkits highlight potential issues to be addressed but also provide valuable insight into the diversity of these populations in terms of their ability and desire to engage with new digital resources. They help to bridge the potential generational gap between designers and end-users and to break down ageist stereotypes of later life. The results of GOALD's co-production approach thus affirm Mannheim et al's (2023: p1198) conclusion from their scoping review of research on user-involved digital development processes with older adults that 'more inclusive design, positive and nonageist discourse, and viewing older persons as partners led to favourable results.'

Finally, the GOALD project has progressed the aims of the Healthy Ageing Challenge by assisting businesses to develop and deliver digital solutions to promote health, well-being and social connectedness in later life. The SBD RP specifically enabled the unique interdisciplinary/intersectoral collaboration necessary to bring digital health, physical activity and gerontological expertise together across research, business and real-world settings to address the challenge of developing appropriate usable health technologies for older people.

Note

¹ <https://www.plymouth.ac.uk/research/centre-for-health-technology/goald>

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