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¹ L = Legal agreement, O = Other, P = Plan, PR = Prototype, R = Report, U = User scenario

² PU = Public, PP = Restricted to other programme participants (including the Commission Services), RE = Restricted to a group specified by the consortium (including the Commission Services), CO = Confidential, only for members of the consortium (including the Commission Services)

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Glossary

HCI: Human-Computer Interaction

QoL: Quality of Life

ICT: Information and Communications Technology

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1. Overview

This deliverable intends to inform three aspects of the work in Anathema: the design of the sexual health promotion programme, methods to engage users and the design of the application. Therefore, the document is divided in two large groups: Section 2 concerns Sexual Health and provides an overview of sexual health and unmet needs, particularly among older adults, stroke survivors and colorectal cancer patients. It then focuses on existing instruments and interventions, including online interventions. Section 3 is devoted to Interaction Design. It begins with an identification of best practices to involve users in user research around the topic of sexual health, moving then to aspects related to applications, including usability issues, technical possibilities for smartphone-smartphone interaction, design & user experience, and finalising with an overview and benchmark of existing products which relate to Anathema. To ease further reading, bibliography is presented per major section, i.e., sexual health and interaction design.

2. Sexual Health

2.1. Defining the problem

Sexual health is an important dimension of global health and is strongly related to physical and psychological health, as well as to the perception of wellbeing and quality of life (World Health Organization, 2006). Previous studies suggest being sexually active and experiencing a “positive sex life” is associated with a variety of benefits for psychological and physiological wellbeing, such as improved mental health, increased heart rate variability, and lower risk of certain cancers and coronary events, being associated with lower annual death rates. However, the experience of a positive, healthy and fulfilling sex life is frequently threatened by the ageing process and the diagnosis of certain medical conditions and chronic diseases along individuals’ lifespan (Traaen et al., 2016).

2.2. End-users

In Anathema, primary, secondary, and tertiary users are equally important and will provide critical contributions in different phases of the project. Primary users will be our target population for the programme, divided in three groups: older adults (age 55 or above), colorectal cancer survivors and stroke survivors (further described below). Secondary users will be certified clinical practitioners and trainees in the fields of psychology or sexology, which may be interested in using the contents with their clients/specific training. Tertiary users will be managers of nursing homes, hospitals, clinics, or other kinds of care organisations, which may be interested in purchasing Anathema for their organisation.

2.2.1. Older adults

Global population continues to grow in unprecedented manner, as older population with 65 years old or above is outnumbering younger subjects (United Nations, 2019). The role of age on sexual function and behaviour is still unclear, with studies demonstrating on the one hand that ageing does not necessarily lead to sexual difficulties (Laumann et al., 2005) and yet that sexual encounters decrease with age (Herbenick et al., 2010), with an increasing likelihood to develop sexual difficulties as age progresses (Peixoto & Nobre, 2015). In the presence of sexual complaints, erectile dysfunction appears to be more prevailing in older men, with 12.9% to 28.1% of a worldwide sample presenting erectile difficulties (Laumann et al., 2005). Regarding older women, the lack of sexual interest seems to be the main sexual complaint, with 25.65% to 43.4% reporting sexual desire difficulties (Laumann et al., 2005). Even though physical changes inherent to the process of ageing may contribute to prejudices in sexual function, physiological alterations may not necessarily result in decreased sexual satisfaction (Fisher et al., 2010), which rather indicates a greater variability in sexual expression in older age (Hillman, 2014).

Sexual health rights recognize the positive effects of healthy sexual experiences on personal fulfilment and well-being throughout the lifespan (WAS, 2008; WHO, 2015). In fact, healthy ageing appears to encompass the maintenance of healthy sexual experiences in older age (Kirkman, Fox, & Dickson-Swift, 2016).

2.2.2. Colorectal cancer survivors

Colorectal cancer is the most common cancer diagnosed in Europe and the third most common worldwide (Stulz et al., 2020). Incidence rates increase with age, as the majority of cases are diagnosed

in patients more than 50 years old, and are closely associated to lifestyle factors, such as poor diet, obesity, consumption of tobacco/alcohol or lack of physical activity (Ferlay et al., 2018).

Colorectal cancer and associated treatments have a major impact on physical, emotional, and psychosocial and interpersonal aspects of patients and their partners lives. Frequent treatment side effects (including fatigue, pain, incontinence) along with severe emotional burden (anxiety, depression), contribute to the avoidance of social contact and sexual intimacy, deteriorating patient's overall quality of life.

2.2.3. Stroke survivors

Stroke can be regarded as a non-traumatic brain injury, often resulting in cognitive, physical, emotional, or behavioural damage (Sacco et al., 2013). Stroke survivors often experience transitory or permanent physical changes (e.g., muscle weakness, stiffness, tightness, pain, altered sensation, mobility, fatigue and incontinence), emotional/mood changes (e.g., anger, irritability, sadness, depression and anxiety symptoms, decreased sexual desire), and relationship issues (e.g., care-giver/care-taker imbalance, communication issues, confidence and self-image) (Stroke Foundation, 2021).

2.3. Impact on sexual health

While sexual health is considered an aspect of health in general, to this day there are still many challenges in recognizing and addressing the sexual health of specific groups, such as older people and people with chronic diseases. The impact of ageing and chronic disease on sexual health is often neglected by professionals and the society overall.

Regarding our target groups, recent studies have shown that maintaining sexual interest in older age is consistently associated with higher successful ageing across four European countries (Stulhofer, Hinchliff, Jurin, Hald, & Traeen, 2018). As for colorectal cancer patients, significant impairments in sexual functioning and poor sexual satisfaction are frequent, which put such individuals and their partners at higher risk of experiencing a poor sexual health and quality of live (Stulz et al., 2020; Sutsunbuloglu & Vural, 2018). Regarding stroke survivors, research accounts for the high prevalence of sexual dysfunction after the stroke event, ranging from 20% to 75% (Park, Ovbiagele, & Feng, 2015; Stein, Hillinger, Clancy, & Bishop, 2013). Like other disabled people, stroke survivors suffer with myths and negative attitudes towards their sexuality. Namely, beliefs regarding asexuality/hypersexuality, along with the ideology of heteronormativity, lead to permanent repression of the sexuality of people with disabilities (Brodwin & Frederick, 2010; Esmail et al., 2010).

2.4. Interventions

Psychological interventions on sexual health are aimed at promoting a sense of sexual well-being, above and beyond restoring sexual functioning. Mainstream interventions are characterized by strategies and techniques focused on sexual response and sexual dysfunction (e.g., sensate focus, systematic desensitization, start-and-stop, etc.) (Masters & Jonhson, 1970). More recently, cognitive-behavioural models of sexual response have been developed, adapting cognitive-behavioural strategies to challenge dysfunctional sexual beliefs and automatic thoughts (e.g., Soares & Nobre, 2012). Mindfulness-based techniques have also been implemented in sexual health interventions, with proven efficacy and benefits (e.g., Brotto & Heiman, 2007; Brotto et al., 2016).

Sexual health interventions targeting older adults and people with chronic diseases may share characteristics with mainstream sexology, but they have also specificities. It is often more important to address issues such as practical adaptations for physical activity (e.g., sex positions, sex furniture, bladder and bowel control), readjustment of relationships and exploring new ways of obtaining sexual pleasure (Pieters et al., 2018). It requires multidisciplinary work and institutional restructuring, as these groups are often engaged in several organizations.

Several studies address the promotion of sexual health in older men and women. Many studies aim at reducing sexual complaints regarding changes in sexual function through sexual education programmes. White and Catania (1982) developed a psychoeducational age-oriented program that focused on modifying attitudes, knowledge and behaviour regarding sexuality in three groups: older men and women, nursing home staff and adult family members of older adults. Results indicated an increase of permissive sexual attitudes in older age and knowledge about sexuality in all three groups. Also, the experimental group of older individuals reported an increase in sexual behaviour and satisfaction, suggesting that intervening at a preventive level contributes to enhance sexual health indicators in older age.

Going further from sex education, Trudel and colleagues (2008) developed an intervention programme for older retired couples wishing to improve their marital and sexual life. The Marital Life and Aging Well Program (Trudel et al., 2008) aimed at improving three aspects of the sexual and marital life of older couples using cognitive-behavioural techniques: communication, problem solving, and sexual and non-sexual intimacy. Post-intervention results indicated that participants reported an improvement both in sexual function and satisfaction. However, the intervention results tended to decline after 1-year follow-up, suggesting the application of “booster” sessions to maintain the effects of the intervention over time.

More recently, the Good Enough Sex (GES) approach was applied to sexuality in older age by McCarthy and Pierpaoli (2015). Grounded in a comprehensive biopsychosocial framework, the GES approach offers an integrative model to enhance intimacy and pleasure, providing a multidimensional clinical approach to assessing and treating sexual dysfunction in late adulthood. Studies show that it is feasible to positively modify aspects of relational and sexual experience in older age. Increasing longevity, combined with growing expectations of maintaining an active and healthy sexual experience, underline the need for research on sexual well-being of older individuals and couples (Traeen, et al., 2016), thus the relevance for developing resources to promote healthy sexual ageing.

As for colorectal cancer patients, research has demonstrated the effectiveness of psychosocial interventions (e.g., educational interventions, cognitive-behavioural therapy, relaxation training, supportive group therapy) in improving overall physical, psychological and social functioning, and quality of life in these individuals (Hoon, Chi Sally, & Hong-Gu, 2013; Mosher et al., 2017). However, there is still limited research on the effects of sexual health interventions in patients with colorectal cancer (Mosher et al., 2017). Brotto et al. (2017) tested an online, 12-week psychoeducational program which included elements of mindfulness meditation, for sexual difficulties in survivors of colorectal cancer and results indicated significant improvements in sex-related distress, sexual function, and mood in women, but not for men (Brotto et al., 2017). Given the reduced evidence available, it is of utmost importance to develop specialized, accessible, and patient-tailored sexual health care to address colorectal cancer patient’s sexual health and well-being.

No sexual intervention studies were found targeting the stroke survivors' group. However, these patients are often included in heterogeneous groups of people with disabilities, as cognitive and physical impairments lead to similar sexual needs (Stein et al., 2013). In this regard, it is worth mentioning a pilot study with physically disabled women, where mindfulness-based techniques were included in a psychoeducational group approach, with benefits in decreasing inner judgment and promoting awareness of the present moment (Hocaloski et al., 2016).

2.5. Instruments

The literature review enabled the identification of relevant research measures to be implemented to the project, in order to co-design the intervention and assess its efficacy. Different research measures will be used across the various stages of the project, as part of the mixed-methods research with a participatory approach that characterizes Anathema project. The different assessment instruments to be used in each study are described below and will be tailored to participants' gender, sexual orientation, condition, and specific study they are participating in.

1) *Study 1 – Populations' characterization and requirements' gathering* Sociodemographic and clinical background questionnaires tailored to each target group;

- Charlson Comorbidity Index (CCI; Charlson, Pompei, & MacKenzie, 1987);
- Assessment of sexual and reproductive health (ad-hoc measures);
- Sexual attitudes questionnaire (Traeen, et al., 2018);
- Multidimensional Scale of Sexual Well-being (Štulhofer, Jurin, Graham, Enzlin, & Træen 2018);
- Information on Sexual Health: Your Needs after Cancer Questionnaire (InSYNC; Crowley et al., 2015)
- European Organisation for Research and Treatment of Cancer sexual health questionnaire (EORTC SHQ-22/EORTC SHQ-C22; Oberguggenberger et al., 2018);
- Digital Technology use and proficiency;
- Focus groups semi-structured scripts³.

2) *Study 2 – Anathema's co-development and usability assessment* Sociodemographic and clinical background questionnaires tailored to each target group;

- Artifacts created by participants in co-design workshops;
- Focus groups semi-structured scripts³;
- Usability tests observation grids³;
- System Usability Scale.
- Semi-structured interview scripts³;

³ The scripts will be developed afterwards, based on literature review and the results from the first studies.

3) Study 3 – Acceptability, feasibility, and efficacy pilot study Screening clinical interviews;

- Sociodemographic and clinical background questionnaires tailored to each target group;
- Charlson Comorbidity Index (CCI; Charlson, Pompei, & MacKenzie, 1987);
- Sexual Function (FSFI Rosen et al., 2000; IIEF; Janssen et al., 2002);
- Sexual and relationship satisfaction (GMSEX, GMREL; Lawrence & Byers, 1998);
- Sexual Pleasure (SPS; Sanchez, Crocker & Boike, 2005);
- Sexual distress (FSDS-R; Derogatis et al., 2008);
- Psychopathology (BSI-18; Derogatis, 2001);
- Sexual Beliefs (SDBQ; Nobre et al., 2003);
- Automatic Sexual Thoughts (SMQ; Nobre & Pinto-Gouveia, 2002);
- Mindfulness (FFMQ-15; Gu, Strauss, Crane, Barnhofer, Karl, Cavanagh, & Kuyken, 2016);
- Psychological Inflexibility (AAQ-II; Bond, et al., 2011);
- Quality of Life (WHOQOL-BREF; WHOQOL GROUP, 1998);
- Users' activity logs registered at Trial Monitor (e.g. login in dates and time, modules assignment, treatment progress, answer to questionnaires, etc.)
- Semi-structured interview scripts³.

2.6. Online interventions

Despite evidence of the efficacy and cost-effectiveness of Internet-delivered interventions for several psychiatric and somatic conditions (Carlbring et al., 2018; Dnker et al., 2015), literature focusing on sexual health online interventions is scarce (Kirana et al., 2020). Most studies focusing on the topic targeted adolescents (DeSmet et al., 2015), college students (Bailey et al., 2010), men who have sex with men (Melskin et al., 2021) or conditions such as male and female sexual dysfunctions (van Lankveld, 2016; Andersson et al., 2011; Hucker & McCabe, 2014). Only a few targeted sexual difficulties related to chronic conditions (Karim et al., 2020). Among these, cancer is the most frequently researched condition (Kang et al., 2018), with studies including patients with gynaecological (Schover et al., 2013), breast (Hummel et al., 2017), prostate (Wootten et al., 2017) and, colorectal cancer (Brotto et al., 2017). The level of evidence for the benefits of these interventions, although promising, is still unclear and patient engagement remains a challenge (Wootten et al., 2016; Kim et al., 2015; Schover et al., 2020).

To the best of our knowledge, no studies assessed yet the efficacy of Internet-delivered interventions aiming at promoting sexual health in stroke survivors or older adults. Nevertheless, professionally guided-online sexual rehabilitation programmes were identified as highly consensual in a recent Delphi study involving stroke survivors, their partners, clinicians and researchers (McGrath et al., 2019) and evidence suggests Internet-delivered sex therapy is effective in improving psycho-sexual outcomes in chronic patients (Karim et al., 2020; Kang et al., 2018).

However, access to such programmes relies heavily on the delivery method, and involvement of end-users in the design process is critical to ensure acceptance, adoption, and adherence. A recent systematic review on mHealth interventions for sexual health among adults with chronic diseases (Karim et al., 2020) reported no studies with interventions delivered through smartphones. All analysed studies used a website for intervention delivery, failing to leverage mobile devices' advantages in this context, namely, "convenience, privacy, anonymity and more interactive treatment for sexual dysfunction". Additionally, only one study adopted a Participatory Design approach (Winterling et al., 2016). Thus, conducting Participatory Design implementation research aiming at developing evidence-based

smartphone-delivered sexual health interventions, such as Anathema, is crucial to overcome barriers to treatment seeking, and improve older adults and chronic patients' QoL.

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3. Interaction Design

3.1. Design research methods

Sexuality and intimacy are under-researched in Human-Computer Interaction (HCI) and in Design, especially considering user groups such as older adults, LGBTQ or people with chronic diseases. The existing research focuses more on youth and younger adults.

Despite the shortcomings, we consider there is past work which can provide some guidance to design methods to be used in Anathema. As a first consideration, we note how many authors chose to use group activities (Almeida et al., 2016; Cook et al., 2021; Gkatzidou et al., 2013; Liang et al., 2020; B. Schulte et al., 2021; Wood et al., 2017). Some authors report on enabling participants to choose to join same-sex or mixed-sex groups (Cook et al., 2021; Gkatzidou et al., 2013). There is also a general emphasis on storytelling (Cook et al., 2021; B. Schulte et al., 2021) and on arts-based research (Cook et al., 2021; Liang et al., 2020; Wood et al., 2017).

In prior work with adolescents (Wood et al., 2017) or with adult women (Almeida et al., 2016), humour is used to address issues which are taboo, as a way to engage users with the technology and create comfort in addressing otherwise embarrassing topics. Humour is also associated with designing methods which enforce a positive attitude towards the subject in discussion. For instance, Wood et al. (Wood et al., 2017) designed activities with users in which participation itself was positive, Cook et al. (Cook et al., 2021) who were co-designing condoms with young user groups, focused on positive issue of pleasure than on negative ones, such as safe behaviours or negative consequences of condom non-use.

Another technique is the embodiment of interaction by reflecting/externalising parts of the human body, or emotions, in a screen, wearable or analogue medium, so that users can deal with their bodies and emotions under new lenses (Almeida et al., 2016; Cook et al., 2021).

Serious games are also used with the purpose of assisting with education and promoting conversation in group activities. Cook et al. (Cook et al., 2021) used a variation of the Life Happens exercise, which has a playful component to it. The authors found that the collective and game exercises in and of themselves de-stigmatised the issues under discussion with the groups. Wood et al. (Wood et al., 2017) found that games were helpful in this regard and furthermore concluded that analogue games were more praised than digital ones, because they were easier to reproduce by anyone. However, regarding the sensitivity of the topic and particular user groups' norms, there can be a fine line between what is playful and what is not, which can offend users and place researchers in difficult or uncomfortable situations. Liang et al (Liang et al., 2020) devised a protocol for stressful situations and opted to moderate group discussions that were happening online among research participants. Cook et al (Cook et al., 2021) pre-tested activities more than once to prevent miscommunication and uncomfortable situations.

Researchers also seek to adapt to participants' preferred means of interaction and communication. Liang and colleagues (Liang et al., 2020) had in-person group activities which involved discussion and placing oneself in a certain part of the room to communicate what their position was in relation to a certain topic (Four Corners exercise), but they also complemented the method with Asynchronous Remote Communities using Discord, which enabled participants to discuss issues asynchronously and complete exercises online.

There seem to be common outcome trends in participatory design research around the topic of sexuality and intimacy: participants steering conversations from the main subject into related ones which are relevant for their community (e.g. help in coming out, etiquette in LGBT, finding local support) (Cook et al., 2021; Liang et al., 2020); participants showing concerns about final design being discreet/non-stigmatising/non-descriptive (e.g. logos not evidently associated with subject of sexuality and intimacy) (Gkatzidou et al., 2013; Liang et al., 2020); participants showing concerns about credibility of information sources (Liang et al., 2020), privacy and confidentiality (e.g. concern with notifications) (Gkatzidou et al., 2013); as well as participants requesting personalisation features (Gkatzidou et al., 2013; Liang et al., 2020).

There seems to be benefit in investing on group activities and in designing exercises within these activities which 1) deconstruct beliefs around the subjects, 2) support participants in expressing their ideas, feelings and opinions through visual representations or through their own bodies, 3) enabling peer group discussions (e.g. by age, by gender identify, etc.), and 4) in seeking ways to promote a comfortable environment for researchers and participants alike, including pre-testing of exercises.

3.2. Human-Computer Interaction

In the scientific field of HCI, designing for human experience, wellness or embodiment has become part of what is known as the *Third-Wave HCI*, which also includes a new set of studies and technology experiments on human intimacy (Almeida et al., 2020). The use of tangible and electronic objects has been explored within HCI as means to get research participants to explore their own bodies (Almeida et al., 2016) or to imagine future scenarios (B. F. Schulte et al., 2020). In Anathema, we do not expect to engage in the development of this kind of products, but they are inspirational as design research means and we expect to be able to use such techniques in tandem with strategies defined in the previous section.

Regarding the commercial product, Anathema will have the face of digital, two-dimensional, user interfaces to be accessed via desktop or mobile devices. Nevertheless, we will research the possibility of having devices interacting with one another to ascertain whether these kinds of interactions would be useful for the successful delivery of the sexual health promotion programme.

We will also use best practices and research how to make human-computer interactions inclusive, considering the audience may differ in terms of, e.g., age, functionality (in the sense of the International Classification of Functioning, Disability and Health (World Health Organization, 2001)), culture or gender.

3.2.1. Smartphone-Smartphone Interaction

The project will explore multi-device interaction considering use cases where sexual health promotion programmes are being followed by a minimum of two people involved in a relationship. There are some technological options, such as the Apple Nearby Interaction (ANI) and Android's Nearby platform API, enable multi-device intercommunications. However, there may be advantages and disadvantages to each. For instance, in the case of ANI, it requires the system to run on iOS and requires iPhone 11 or over⁴. While for the latter, the Android 6.0 or later is required with Nearby Share permission enabled,

⁴ <https://developer.apple.com/documentation/nearbyinteraction>

which might be challenging for a novice digital technology user, as is often the case with older adults⁵. For Android to iOS communication there is Google API Nearby Messages. Its SDK is available for both OS and device discovery is made via Bluetooth. After pairing, information exchange is done via the Internet⁶. Any updated iOS device should support this API. In Android, the device must support Bluetooth Low Energy and have Google Services installed.

Another example is the interaction of bumping two smartphones against each other to exchange file. This was once made available by the mobile app Bump, which is now discontinued. There are options for transfer via NFC between Android devices or Airdrop between iOS devices. Another option is to use multiple screens as a single display, which allows the visual effect of swiping elements from one device to the next^{7, 8}. Screens can also complement each other's functions, such as using one of the screens as a keyboard⁹.

There are also web-based applications, usually used for educational purposes allowing different users to send answers to quizzes shown on a screen using their own mobile devices. Well-known examples of such as applications are Kahoot!¹⁰ and Mentimeter¹¹.

Another method is the usage of network socket communication which requires a server to enable bi-directional communication between two more devices; this is one of the most common technological approaches adopted in real-time device communication; this approach, in combination with other sensory input data, enables a myriad of implementation possibilities¹².

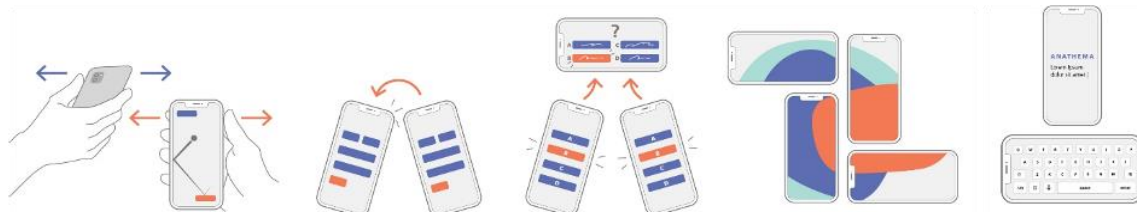


Figure 1 Examples of multi-device interaction: Apple Nearby Interaction, bumping phone to exchange files, answering quizzes, showing single image through multi-devices and using smartphone screen as a keyboard.

3.3. Design and user experience

Acknowledging Anathema's scope in developing technology to support and promote sexual health, we must consider designing pleasurable, intimate, and playful experiences. Experience in human-product

⁵ <https://developers.google.com/nearby>

⁶ <https://developers.google.com/nearby/messages/overview>

⁷ <https://github.com/paulsonntag/swip>

⁸ <https://nanoport.io/magnetic-connector/>

⁹ https://play.google.com/store/apps/details?id=com.locnet.an2an&hl=pt_PT

¹⁰ <https://kahoot.it/>

¹¹ <https://www.mentimeter.com/>

¹² https://en.wikipedia.org/wiki/Network_socket

interaction can be created and shaped through technology. Meaningful experiences for users can evoke emotions, sensations, and other responses (Desmet & Hekkert, 2007). Recognizing users' experience and products' importance as mediators of intimate and sexual human relationships is expected to lead to the design of an engaging, meaningful and positive sexual health intervention. Exploring intimate human behaviors and understanding the use of existing devices in people's relationships should inspire the design of technologies to support and mediate intimacy (Howard et al., 2004).

3.3.1. Pleasurable experience

The field of Design Research has been concerned with how design can elicit emotions in users. One of such lines of research is that of pleasure. Jordan (2002) has elaborated a typology of pleasure with products consisting of: *physio* (delight of the human senses); *psycho* (positive emotions from cognitive processes, e.g. mastering a skill); *socio* (how a product influences sense of self); and *ideo* (product's relation to one's moral values). Looking specifically at product meaning, Schifferstein and Zwartkruis-Pelgrim (2008) have identified four facets which are relevant for person-product attachment: *enjoyment*, *individual autonomy*, *group affiliation* and *life vision*. Another example is Desmet and Hekkert's (2007) categorization of product experience in three types: *aesthetic* experience, experience of *meaning* and *emotional* experience, followed by strategies to elicit such experiences.

Pleasurable experiences embrace delightful moments that allow humans to establish emotional connections. Products designed to please human senses and elicit diverse emotional responses drive individuals to seek pleasure and positive emotional affect (Desmet & Hekkert, 2007). Human perceptual systems enable the level of sensory pleasure, denoting the relationship of an object's perceptive qualities and the emotions felt by the user, which Norman (2005) refers to as the *visceral* level of emotional design. Hence, critically immersing in embodied experiences provides an interactive engagement with sensual and visceral responses, cultivating a personal perspective to design for the subjective qualities of interaction (Bardzell & Bardzell, 2011). Norman (2005) further categorizes levels of emotional design into *behavioural* and *reflective*.

A key tool of interaction design towards pleasurable experiences is aesthetics, even by drawing users to reach a greater aesthetical appreciation of one's sexual experience and this aesthetic experience can be rewarding in itself (Bertelsen & Petersen, 2007). Aesthetic experience, although often associated with sight, can be applied to different senses, enhancing pleasure, body perception, and multimodal interactivity, which are crucial for intimacy and sexuality (Desmet & Hekkert, 2007; Kannabiran et al., 2020). Some fragrances can induce pleasurable emotions, reinforcing one's sexuality and other sex-related concepts such as attraction and self-love (Bardzell & Bardzell, 2011). Touch is a sense very instinctive and primitive that enables physical connection. Such tangibility allows being and feeling connected, in intrinsic intimacy relationship that can happen between users and their cellphones that they hold in their hands. An embodied understanding is central to design for in-body intimate experiences, as it influences design an experience through a touch-oriented perspective. Designing sex toys goes beyond their intended functionality, concerning portability concerns, suggesting mundane dimensions to carry pleasure objects around if someone desires to transport a sex toy in the pocket (Bardzell & Bardzell, 2011).

As examples of existing products using other senses beyond sight are Wisp and Dipsea. Wisp¹³ is a brand born in 2016 focusing on empowering women towards a sensual revolution, as it encompasses personalized jewelry with fragrances and massage stones. Jewels are artefacts that people like to wear to adorn themselves. Wisp's appeal to the smell and touch senses reinforces sensuality, seduction, pleasure and self-love experiences and an intimate relationship between a user and those products. Additionally, sound is crucial in sexual intimacy contexts since noises can be displeasing and ruin the ambience (Bardzell & Bardzell, 2011). Dipsea¹⁴ is a storytelling audio smartphone application with erotic stories to spark imagination, therefore, using the sense of sound combined with meaningful stories to create pleasurable user experiences.

3.3.2. Intimate experience

Intimacy is a very stretchable concept involving sexual and non-sexual relationships, while sexuality covers emotional intimacy, experiential qualities, and intrinsic physical interaction (Bardzell & Bardzell, 2011). Sexual and intimate moments are fundamentally mysterious and fragile (Bertelsen & Petersen, 2007; Howard et al., 2004). Dealing with this sensitive issue involves understanding intimate and sexual interactions expressed among human beings, relating to the self as private and closely experienced (Bell, 2004). As technology becomes omnipresent in mundane everyday objects, it can serve as an enabler or disabler of intimate experiences, influencing sexual life. Ubiquitous computing focusing on intimacy and sexuality may assist the HCI field in avoiding technology that might harm intimacy and private life (Bertelsen & Petersen, 2007). Exploring physical intimacy, from the bedroom to social media, to technologies for couples in long-distance relationships, to embodied interaction (Bardzell & Bardzell, 2011) will contribute to design interactive technologies to support intimate experiences.

Invisibility is a factor that Bertelsen & Petersen (2007) state as crucial to sexual life, as it requires a safe and exclusive space. Intimate behaviours demand privacy, self-disclosure and, in dyads, depend heavily on communication. Since the inability to communicate seems to be the most common obstacle in intimacy, technologies present in domestic settings can impact communication (Bertelsen & Petersen, 2007), hence, promoting the communication of love and intimate messages using symbols.

Kaye and Goulding (2004) and Howard et al. (2004) analysed devices as intimacy mediators for users to communicate with their partners within co-designing sessions. Despite participants' artefacts differences, the devices they envisioned had similar interaction purposes. Devices were small to be discreet, others simulated handholding and touch sensations. For instance, the experience of physically interacting with a product, focusing specifically on the tactile rather than on the visual aesthetic, refers to the concept of aesthetics of interactions, the beauty of use, where the aesthetic interaction with the physical object reinforces this intimate human product bond.

3.3.3. Inclusive design

Inclusive Design, also known as *Universal Design* or *Design for All*, is an approach to design which seeks to include the widest range of the population as users of any given product regardless of age, size or abilities (Clarkson & Coleman, 2015). Inclusive Design is often associated with Accessibility, and

¹³ <https://www.wisp.me.uk/>

¹⁴ <https://www.dipseastories.com/about/>

accessibility is indeed a part of Inclusive Design. However, while accessibility focuses on rules to be followed on the designed product/space/service and focuses on motor, sensory and cognitive impairment, Inclusive Design is more of an approach to designing (Clarkson et al., 2003). As an approach, it seeks to involve potential users in the design process itself – often described as ‘design partners’ (Ho et al., 2009).

Accessibility and usability-wise, there are several resources on rules and best practices which can guide Interaction Design in Anathema. Generally, Anathema will use the Web Content Accessibility Guidelines from the W3C WAI¹⁵. Regarding mobile user interfaces inclusive of novice digital technology users, as may be the case with some of Anathema’s users, Anathema will especially build on Fraunhofer AICOS’ experience in designing with older adults and people with chronic diseases. Prior research has informed us about appropriate mechanisms for easy readability, navigation and interaction (Correia de Barros et al., 2014, 2013; Nunes et al., 2016), as well as learning means (Ribeiro & Correia de Barros, 2014) for novice users.

Another relevant area of exploration in terms of interaction design is illustration, which can be quite significant for inclusion, as well as to tackle issues of stigma. Since Anathema will privilege non-stigmatising, non-binary and non-gendered visual representations, it will build on prior work done for an audience primarily composed of older adults (Correia et al., 2020). In this prior work, some of the inclusive design strategies used were to avoid representation of skin colour in human figure, avoid representation of ideals of beauty or to avoid association of sex to certain human activities (Figure 2).

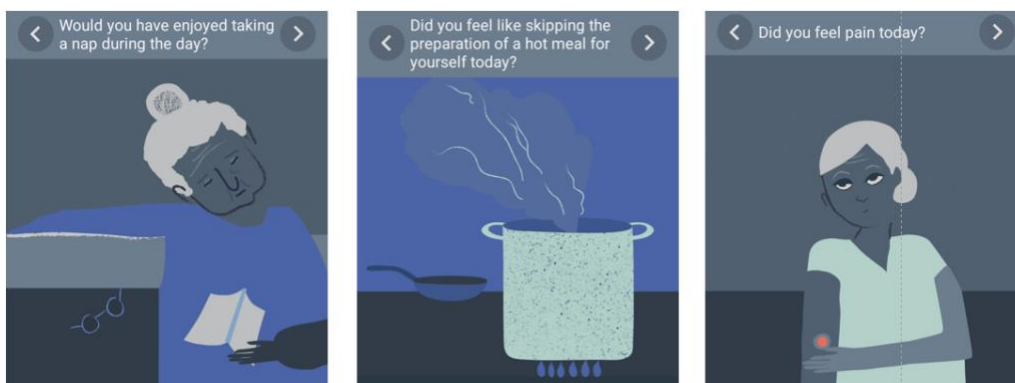


Figure 2 Illustrations used in mobile delivered questionnaire on older adults’ daily activities.

3.4. Products

Digital products, from the web to mobile devices, blend technology and information that enable and deliver experiences for various consumers’ services, such as health, entertainment, and education, to name a few. These products comprise all sorts of media that rely on digital devices to deliver information, such as social media platforms, websites, awareness or advertising campaigns, and video games. Digital products can portray as mediators of sexual and/or intimate interaction and communication (Howard et al., 2004; Kaye & Goulding, 2004). From Information and Communication Technology (ICT) and smartphone applications to sex toys, we broadened our research on the state-of-the-art in order to find inspiration and gain knowledge from other types of technology. Previously

¹⁵ <https://www.w3.org/WAI/fundamentals/components/>

focusing on the deep subjective qualities of interaction design, such as aesthetics, experience, pleasure, and embodiment, it is possible to transport that knowledge to understand these products design processes and outcomes.

3.4.1. ICT

ICT encompass technologies that support user's interaction *in* or *with* the digital world. These cover all uses of digital technology, enabling users to access, recover, store, transmit, and manipulate information in a digital form. From computer-based technologies to digital communication technologies, ICT circumscribe different products, such as websites, mobile applications and digitally enabled physical devices. ICT, as products, are mediums for users to communicate and interact with, granting a physical and emotional connection with that specific artefact. These interactions can be very personal, resulting from the user's body and senses involvement, enabling a meaningful engagement between them (Desmet & Hekkert, 2007) .

Devices for couples in long-distance to communicate with each other are perceived by Kaye & Goulding (2004) as a different type of communication medium that facilitates to deliver specific messages. Therefore, designing ICT for intimate purposes must shift from mass to personal communication concepts. Approaching pleasant and appealing computing, rather than merely effective, has great potential in providing stimulating and beneficial designs for intimacy and beyond. Bell et al. (2004) mentioned that ubiquitous computing and its omnipresence in people's everyday lives has an extended association with intimacy. As mediators of friends, lovers, relatives, and colleagues' connections, designing for emotional and social reciprocity is crucial for explicitly developing technologies to promote intimacy.

3.4.2. Smartphone Applications

As technology becomes pervasive, it has successfully penetrated people's lives, transforming and conducting the way they live and perform daily activities. Mobile devices are actively involved in people's lives and hence in their sexual and intimate life. With ubiquitous computing it is possible to support rich information about users, and if mobile devices could understand more about them and their desires, they would become more intimately connected (Bell, 2004).

Smartphone applications are software applications designed for mobile devices, such as smartphones, tablets, or smartwatches, that can provide numerous services. For instance, mobile devices becoming the primary mediator to enable individuals to communicate and maintain intimacy at a distance through regular and frequent (audio or video) calls and text messages (Kaye & Goulding, 2004). Mobile phone devices fit in people's pockets and accompany them everywhere, allowing them instantaneous access to all sorts of applications, from online dating to sexual health guided interventions. Exploring possibilities for more intimate computing technology, addressing and accounting for embodied and lived experiences allows physical closeness due to the presence of technology, whether in their pockets and on or in their bodies (Bell, 2004).

3.4.3. Sex toys

Project Anathema does not intend to design or build hardware; nevertheless, we consider that we can achieve great insights examining the realms of sex toys. The features that users find attractive, safe, and aesthetically pleasing can be meaningful for Anathema's design. As well as digital products, a well-

designed sex toy is responsive to human desires and needs. Bardzell & Bardzell (2011) advise framing sex toys into product design to provide critical insights on the state-of-the-art, considering shapes, visual appearance, elegant user interface design, wireless connectivity, and other sensory features, such as music, soft-to-touch materials, and vibration patterns. Sex toys can be both a vibrator and a piece of art as an aesthetically appealing artefact to the eyes and touch. Specifically, the authors describe the advantages of associating features often associated with luxury devices to such technologies in order to counteract stigma.

Sex toys' tangibility increases human perception, embracing all human senses thus, empowering and supporting users' intimate experiences, embodied pleasure, health, and wellness. Hence, simultaneous emerging technologies appeared to provide embodied experiences as digital enablers of physical pleasure, encouraging the industry to embrace high-quality design production and digital technology (Bardzell & Bardzell, 2011). One example is MysteryVibe's¹⁶ Crescendo and Tenuto vibrators addressing and preventing sexual health issues, such as the inability to orgasm or erectile dysfunction. Crescendo's bendable design mimic human fingers to reach, discover and arouse erogenous zones, fully personalized with precisely targeted vibrations for adjusted pleasure and stimulation. Tenuto's design to increase blood flow, extend erection and prolong pleasure can also stimulate the user's partner pleasuring both. Both vibrators connect to a free smartphone application, MysteryVibe App that allows remote control within a nine-meter range, giving the user or the partner the ability to control, download or customize vibration patterns. MysteryVibe's communication design offers an aesthetically pleasing and non-pornographic brand, supported by illustrations rather than explicit anatomical images to explain product usage. The website is also very clear about instructions and diversity in uses, presenting more pleasurable and playful interactions, alone or with a partner, using their Playbook or Play Cards.

3.5. Benchmarking

Table 1 Benchmarking of online/mobile app services including sexual health support, counselling and psychotherapy

Name	Type (Country)	Main Features	Price	Seniors/disease	Smartphone-smartphone interaction
Sexual Health					
Apple Health	App (World)	Tracking menstruation and sexual activity	with iPhone	No	No
Eve	App (World)	Tracking period + emotions + sexual activity + exercise + symptoms + community chat	Free, 8.83€/3 mo, 4.41€/year or 110€ lifetime	No	No

¹⁶ <https://mysteryvibe.com/>

Euki	App (World)	Tracking period, STI, abortion, contraception, sexual activity	Free	No	No
ReGain	Web (USA)	Couples automatically matched with therapist. Messaging not in real-time. Couple approach (fork from Betterhelp)	\$60 - 80 / week	no	No
Professionally guided psychotherapy or counselling					
Talkspace	Web (USA)	CBT, Dialectic BT, mindfulness, psychodynamic therapy Messaging (text, audio, video) or live talk	\$65 – 99 / week	No	No
Betterhelp	Web (USA)	Messaging with therapist Most chats not in real-time	\$65 – 80 / week	No	No
Amwell	Web (USA)	Different kinds of therapy (e.g., dermatology, cardiology...)	\$59 – 99 / consultation	No	No
MDLive	Web + App (USA)	Meeting counsellor or psychiatrist via mobile app, video, or voice call	\$99 consultation therapists, \$259 1 st visit physicians	No	No
MyOnline Therapy	Web (UK)	Videoconference, Live chat, Daily coaching Specialised support for relationships / sexuality	£49 – 99 / consultation £75 / week coaching	No	No
WeCareOn	Web (PT)	Online chat + e-mail	15€ to >60€ / consultation	No	No
Instahelp	Web + App (AU, DE, CH, UK, FR)	Videoconference + Live/asynchronous chat + audio call for relationships/sexuality, among other topics	Online consultation: 49-69€; Classic therapy in praxis: ≈ 120€/unit	No	No
Self-guided psychotherapy or counselling					
Cíngulo	App (Brazil)	Self-guided therapy on anxiety, self-esteem, stress, depression + Tracking emotions + SOS + Self-assessment	\$99.90 / semester	No	No
Moodpath	App (World)	Tracking mood + sharing with therapists + exercises based on CBT + mindfulness	Free or 5.49-84.99€/item	No	No

Blueheart	App (World)	Individual (automatic) plan for individuals and couples based on initial questionnaire: Sensate focus, Communication, Psychoeducation	7 days free & then £10-20/month	No	No
Lover	App (World)	Individual (automatic) plan for individuals	Free, \$19.99/week to unlock goals and content	No	No
Coral	App (World)	Individual (automatic) plan for individuals and couples	7 days free and then \$60/year	No	No

When writing the project proposal, the consortium identified a number of applications against which to benchmark Anathema. A comparative analysis may be found on Table 1. Since that time, three new products were added to the list: Blueheart, Lover and Coral. All the new examples found fall into the category of ‘self-guided psychotherapy or counselling’. They include an initial questionnaire for screening, after which a plan is recommended. Despite self-guided, the products offer the option to have one-on-one, over the Internet, sessions with psychotherapists for additional fees. The products usually require a login associated with an e-mail address, but there are cases in which users can use the app as guests without registration, although they lose the option to track their progress. Visually, the applications place a great emphasis on content writing, on providing interaction breaks and informing users about what the application is doing, and on quality of pictures and illustrations. It is common for applications to avoid explicit figurative images and to resort to rich colours and textures.

For each category in the benchmarking table, we highlight below those which we find to be the best examples in order to identify aspects which Anathema should take into account for Interaction Design and Content Creation. Often, the products’ websites highlight that the applications are built on scientific evidence or through scientific methods. It is often common for product websites to highlight people or organisations behind the product as a mark of credibility. Another common feature is to show KPIs of results, e.g., average time needed for a person to feel better, number of people/couples supported through the product.

In the category of Sexual Health, **ReGain** (Figure 3 to Figure 5) is a reference and fork from Betterhelp (USA). The app invited users to an initial screening to understand unmet needs, followed by questions on preferences regarding therapists, after which the person is suggested a number of therapists registered within the platform. Users contact therapists via asynchronous chat and there is an option to bring the partner into the sessions. Users have the option to schedule activities with therapists and there is the option to attach files in the chat.

Within products for professionally guided psychotherapy or counselling, we highlight **WeCareOn** and **Instahelp**. The first because of particularities of interaction as compared to the majority of applications and the latter because it is the platform of one of Anathema’s consortium members, where Anathema’s outcomes will be included. WeCareOn (PT) is a platform for online, synchronous therapy sessions. Contrary to other applications, where the system finds the therapist, in this product, the user selects a

therapist from an existing, public list (Figure 6). Each therapist lists information on their specialisation areas, CV, and session prices. The platform offers free-of-charge crisis support through a helpline. The product's website has curated content in a blog, where users can learn more on a given subjects (searching by a list of themes or using a search bar). Instahelp (Figure 8 to Figure 10) can be used on smartphones, tablet devices or desktop and is available in different countries/languages. After a screening process in which users identify which topics they want to work on, they are provided with a list of suitable psychologists for their particular need. There is information about each psychologist, including ratings regarding the relationship design or change of symptoms from other users. Interactions happen via chat or calls. Psychologists have at their disposal a series of interventions, which include content and exercises to share with users based on cognitive behavioural therapy and mindfulness. These interventions are assigned individually by psychologists and users can do the assignments at their own pace and as often as they wish. Users can do the intervention privately, without the psychologist having access, or share the information with the psychologist. This makes it possible to debrief the interventions and transfer learnings into everyday life. Design-wise, Instahelp's application is rich in written content and in illustrations. Pictures and welcoming videos are used for psychologists. As with WeCareOn, the website offers specific content for users, as well as psychological self-tests

Figure 11 to Figure 18 show screenshots from **Blueheart**. The screening is quite long, but inclusive of all relationship statuses and sexual preferences. Plans can be defined for couples or for individuals. The dashboard highlights the day's session, followed by carousel of next sessions, another carousel of related information for users who want to learn more, and ends with a card with the option to contact a professional directly. For each session in the plan, there is information on its requirements regarding clothing, location and number of people.

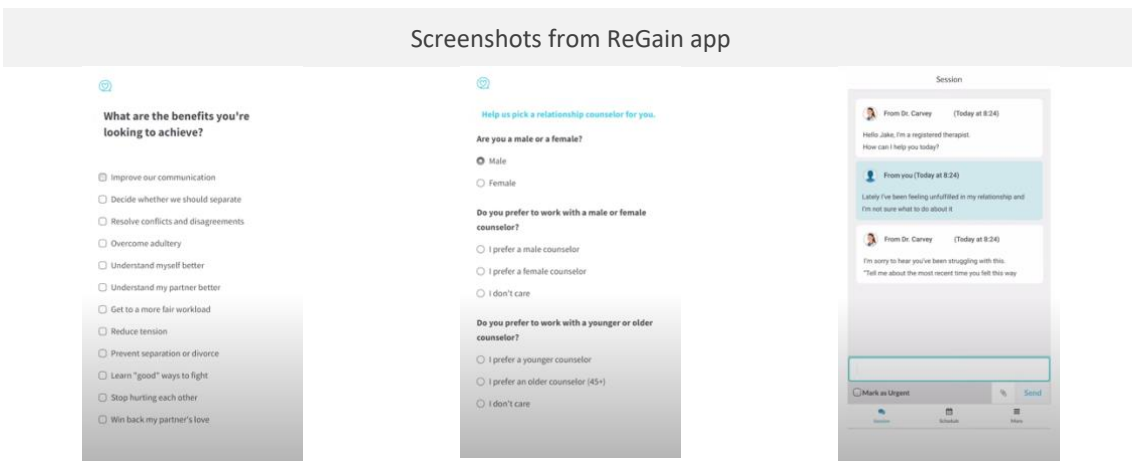


Figure 3 Selecting unmet needs

Figure 4 Choosing therapist's characteristics

Figure 5 Chat session with therapist

Screenshots from WeCareOn app

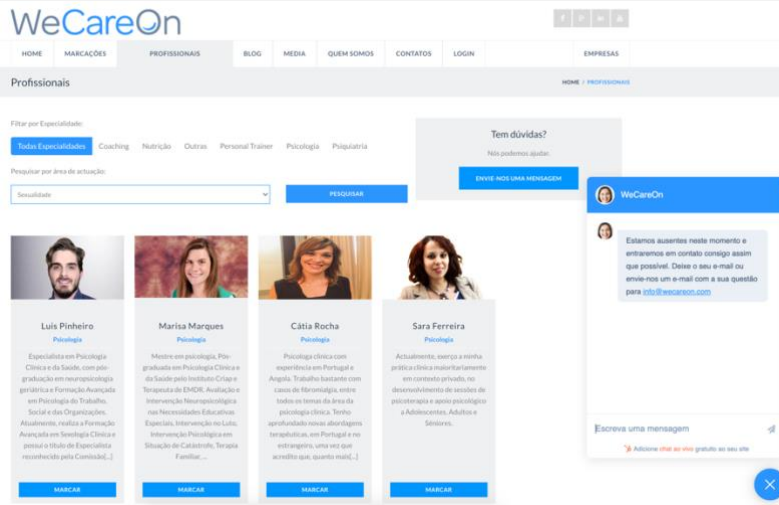


Figure 6 Selecting therapist and view of chatbot

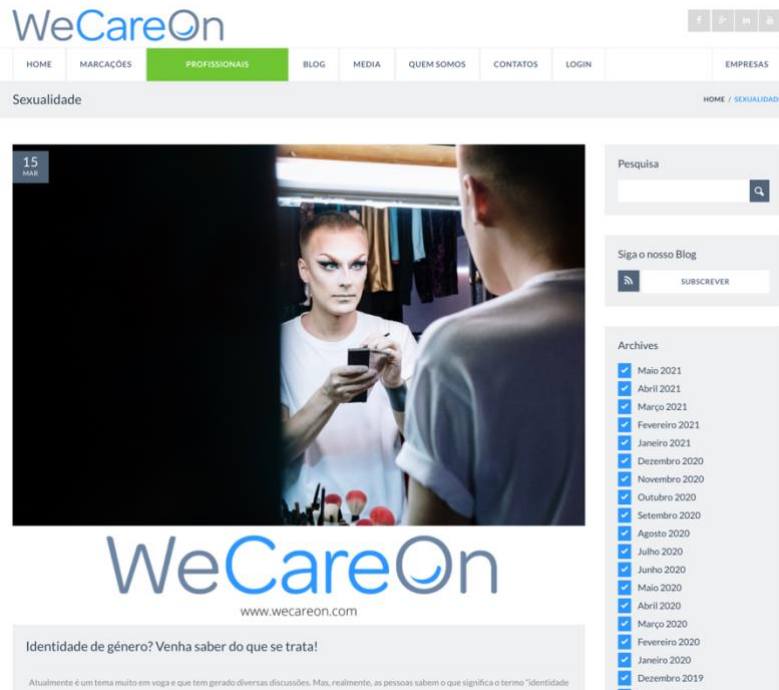


Figure 7 Blog with contents per thematic area

Screenshots from Instahelp app



Figure 8 Information about psychologists

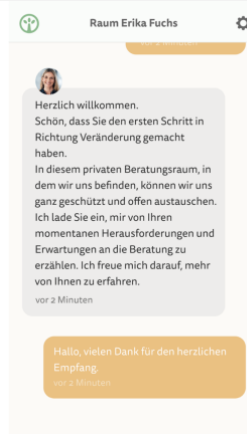


Figure 9 Chat with psychologist

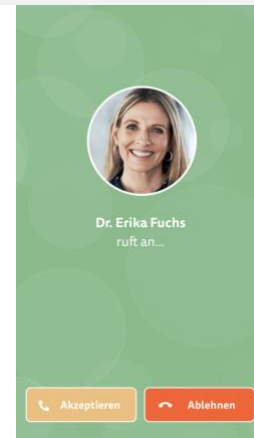


Figure 10 Calling psychologist

Screenshots from Blueheart app

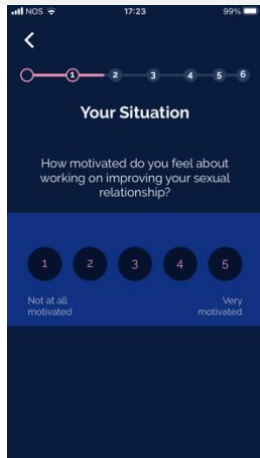


Figure 11 Screening questionnaire

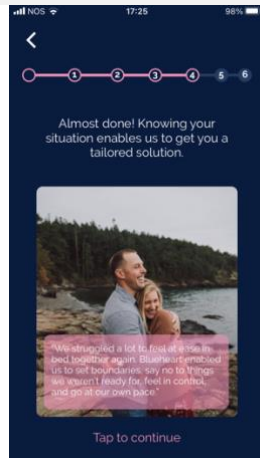


Figure 12 Screening questionnaire

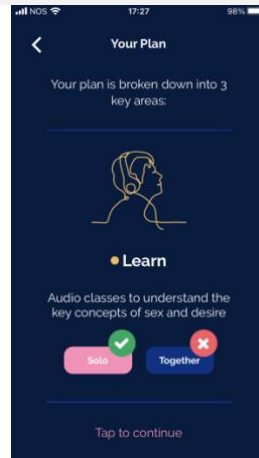


Figure 13 Information about individual plan

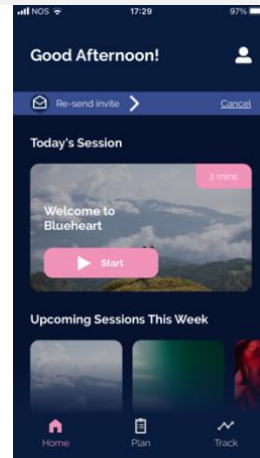


Figure 14 Dashboard (1)

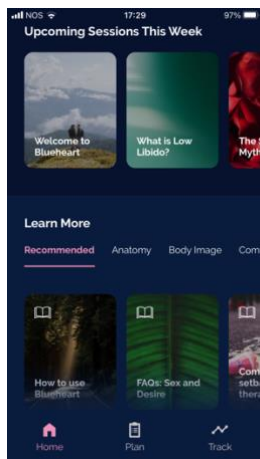


Figure 15 Dashboard (2)

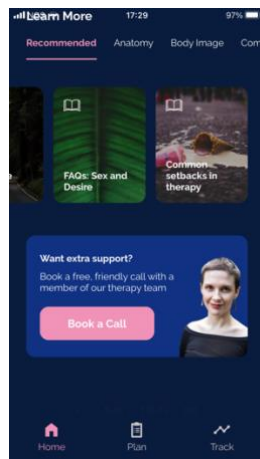


Figure 16 Dashboard (3)

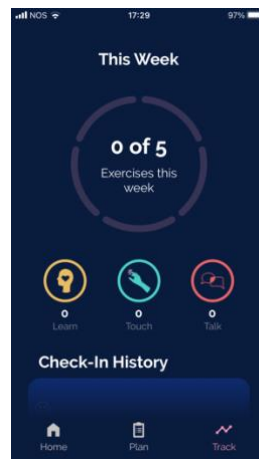


Figure 17 Overview of week activities

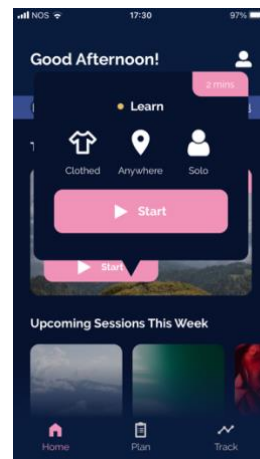


Figure 18 Contextual information on requirements for a session

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