



Beyond Behavior: The Coach's Perspective on Technology in Health Coaching

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ABSTRACT

Rapid innovations in electronic healthcare and behavior tracking systems are challenging health coaches (dietitians, personal trainers, etc.) to rethink their traditional roles and healthcare practices. At the same time, many current e-coaching systems have been developed without explicitly incorporating the healthcare professionals' perspective into the design process. In the current paper, we present three consecutive qualitative studies, starting from the health coach's perspective on successful coaching, progressively zooming in on the potential role and impact of technology as part of the coaching process. Our main finding is that coaches are concerned that introducing technology in the coaching process puts too much emphasis on behavioral information, lowering the attention for the client's lived experience, while understanding those experiences is key for successful coaching. We summarize our insights in a multi-channel communication model and draw implications for the design of supporting technology in health coaching.

CCS CONCEPTS

• Human-centered computing → **HCI theory, concepts and models**

KEYWORDS: Health coaching; self-tracking; behavior change support; e-coaching; mHealth; coach-client relationship; technology acceptance; patient-generated data.

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1 INTRODUCTION

A healthy lifestyle has many benefits. Mortality is on average lower among physically active people than among their inactive peers, and an unhealthy diet is associated with leading causes of death, including coronary heart disease and stroke [29]. However, to attain a healthy lifestyle, established routines or habits have to be broken and deeply ingrained attitudes need to be changed [58]. Health coaches may provide help in this difficult but beneficial process of behavior change.

We define health coaching as a client-centered process where a coach supports an individual client on achieving her goals related to health and wellbeing. The process of health coaching itself is an interpersonal process, where situational awareness, mutual coordination, and substantial knowledge about the personal characteristics and habits of the client are required. In this client-centered process, a good relationship between the client and the coach [47] and good communication skills [61] are of key importance. In related fields, the importance of a good relationship between caregiver and client is also emphasized, for example in psychotherapy [46] and in medical settings [5,56], in order to elicit patient's values [6], and to facilitate shared medical decision making [48].

Over recent years, various e-coaching systems have been introduced that offer some unique opportunities for behavior tracking and interventions which were hitherto unavailable, either to coaches or their clients. Specifically, technologies such as smartphones, activity-trackers and health watches are equipped with a broad set of sensors, which allow for higher resolution and potentially more objective tracking, over longer periods of time, than typically afforded through users' subjective self-assessment. Moreover, advances in (big) data processing enable increasingly personalized and contextualized behavioral recommendations and motivational feedback.

However, by and large, technology in health coaching to date has focused rather exclusively on the client's needs and technology affordances, typically arriving at fully

automated, stand-alone e-coaching systems or apps. Neither the coach's information needs, nor the nature of the coaching process, have received sufficient consideration in the design and research of this technology. In the present paper, we aim to address this research gap by taking the coaches' perspective as point of departure in understanding the coaching process, the role of supporting technology, and the design requirements of technology aimed at supporting the coaching process.

2 RELATED WORK

2.1 Personal Informatics and Patient-Generated Data

Over recent years, interest in Personal Informatics and Quantified Self has been growing, where technology and user-generated data (e.g., from wearable trackers) are employed to increase a user's self-awareness and provide her with actionable insights to support the attainment of a user's self-improvement and health goals [18,35–37]. This literature is predominantly client-oriented – that is, the end-user's needs and goals are the driving force in developing apps and trackers that allow for self-tracking. At the same time, self-tracking is increasingly construed as a social and collaborative activity, inevitably embedded in a social context [17,33,39,55]. This signals that health tracking frequently involves more stakeholders than the primary end-user alone, and that data may be shared. However, self-tracking systems to date have relatively limited functionality in supporting such sharing [33].

In clinical settings, there is a growing interest in the value of personally tracked data to supplement existing clinical data, by providing more contextualized and continuous health information. Research on such patient-generated data (PGD) has a broader focus than the empowerment and needs of the patient; it also studies the clinicians' needs regarding PGD, and the extent to which PGD fits and impacts current healthcare practices and workflows [10,22,27,32,42,54,57,59,60,62]. Even though the use of PGD is increasingly prevalent in chronic disease management, current PGD tools do not adequately support the effective collaboration and communication between caregivers and patients.

2.2 E-Coaching-, Behavior Change- and Persuasive Technologies

In addition to health data being captured by people (patients, clients) using self-tracking technology, technology can also take a more active role in interpreting the data, and providing the end-user with relevant feedback, timely and personalized cues, and motivational rewards, all of which may support health behavior change.

Such e-coaching technology, including Behavior Change Technology [12,44] and Persuasive Technology [20,28], implicitly or explicitly takes on a role of a health coach, cf. [1,45,51]. Health coaching is generally conceptualized as a client – or patient – centered process, supporting the health needs and goals of the client. In line with this, the systems in use to date, be they apps (e.g., Runkeeper, MyFitnessPal) or wearable sensing devices (e.g., Apple Watch, Fitbit), focus primarily on the end-user wearing the device, not on the social or professional context of use.

2.3 The Coach's Perspective in e-Coaching Systems

Designing systems that support the process of healthy behavior change, however, does not imply that technology assisting in this process should focus exclusively on the client. First, as e-coaching technology is, to an extent, emulating the role of a coach, a deep understanding of what constitutes a successful coaching process should be incorporated into the design of e-coaching systems. Second, as both personal informatics and e-coaching systems are frequently part of a larger ecosystem of behavior change agents which explicitly includes human professionals (e.g., health coaches, medical doctors), the design of such systems should also incorporate the perspective of these stakeholders, the dynamics of the interpersonal coaching relationship, and the requirements of a successful coaching process. Although the primary goal of the coach is to support the client, she has her own unique perceptions, information needs and attitudes towards technology that are fundamental to inform the design of e-coaching systems that will be of value to professionals as well as their clients, and not disruptive of the client-coach relationship nor the coaching process. In current literature, the coach's perspective is underrepresented.

3 FOCUS OF THE PRESENT PAPER

This paper aims at understanding the health coach's perspective on the role and requirements of technology in health coaching. Medical treatment as part of the health coaching process are beyond the scope of this paper, since the process of diagnosing and treating diseases are often associated with more strict guidelines and standard procedures, and thus bring different dynamics into the process. We will take the health coach's perspective on the coaching process as a point of departure and will progressively zoom in on the potential role and impact of technology as part of that process. We will address the following research questions: (1) What defines and influences successful health coaching? (2) What are health coaches' perceptions, attitudes, and needs towards

technology in their coaching practice? And (3) what do these results imply for design of technology in health coaching, in order to fully utilize the potential of both human coaches and technology?

To answer these research questions, we conducted three consecutive qualitative studies. In Study 1, through semi-structured interviews, we explored coaches' reflections on the process of health coaching, addressing what defines successful coaching, as well as common barriers and success factors that coaches encounter in their day-to-day practice. In Study 2, using a focus group, we explicitly considered the potential role of technology in health coaching. We explored the extent to which potential technology interventions resonate with current coaching practices and focused on the coaches' perceptions and attitudes towards the use of technology. In Study 3, we observed coaches interacting with clients as well as health-data in a hands-on workshop, allowing for a deeper reflection on the potential role of technology, based on this experience.

In the remainder of this paper, we will discuss each of these studies in detail, and will reflect on the potential role and impact of technology in the coaching process. These insights will be used to formulate design considerations for future technology solutions supporting the coaching process.

4 STUDY 1: EXPLORATION OF THE COACHING PROCESS

4.1 Method

Nine Dutch health coaches (seven women and two men, average age of 37 years, ranging from 25 to 56 years) volunteered to participate in the interviews. On average, they had 10 years working experience, ranging from 2 to 28 years. The coaches were all working on individual basis with healthy clients having health- and wellbeing-related goals, by focusing on diet, physical activity, or both. We interviewed three dietitians, four personal trainers, one coach providing online coaching and one teacher/researcher in coaching, who is also a sports coach.

The interviews, held in spring 2016, were semi-structured, and conducted by one researcher in a face-to-face setting. The duration varied between 30 and 60 minutes. The interview questions were:

1. Can you give examples of things you do and recommend as a coach, and how you motivate your clients? Does this change from person to person?
2. When is coaching successful in your opinion? What contributes to that?
3. Who sets the goal? Can you explain this process?
4. How do you translate a long-term goal into short term activities?
5. Which barriers do you see often with your clients?
6. If you could be a fly on the wall with your clients, what information would you focus on, and what would you do with this information?

As we aimed for a broad understanding of health coaching, we asked about many aspects of coaching (questions 1-5). With the sixth question, we hinted at opportunities for technology, without being overly explicit.

Saturation was used as a stopping criterion: data collection ended when for three consecutive interviews no major new insights emerged. Two researchers agreed that the data was saturated after nine interviews. All recordings were transcribed verbatim, and a thematic analysis was performed following established guidelines [8]. The final coding of the data was executed by two researchers. The inter-rater reliability (IRR), expressed in percentage of agreement per interview per theme, was on average 98.8%, with a minimum of 88.0%. All disagreements were resolved by discussion.

4.2 Results

Four major themes emerged from the thematic analysis, which are summarized in Table 1 along with their subthemes. Below, all themes and subthemes are discussed.

Table 1: List of themes and subthemes

Theme	Subtheme
I: SUCCESS GOES BEYOND ACHIEVING GOALS	a) It is about the experience instead of the numbers b) There is often a more profound issue underlying a stated goal c) Success is also about learning
II: THE VALUE OF A PERSONAL (HUMAN) APPROACH	a) The relationship between coach and client is of key importance b) Social support is a major success factor c) Tailoring advice and coaching style is important and implicit
III: ADAPT THE ADVICE TO SITUATIONAL CHARACTERISTICS	a) Fit the advice to daily life of client b) Contextual information of the client is informative to the coach c) Consider stress & personal barriers d) Not all information is shared
IV: MOTIVATION IS IMPORTANT	a) Behavior change is hard - reasonable expectations are important b) Intrinsic motivation is essential c) Suitable and specific short-term goals help to motivate

4.2.1 Theme I: Success goes beyond Achieving Goals. In the interviews, coaches indicate that coaching is about much more than helping clients achieve their goals. First, many coaches report that success is not always measurable, and often related to experience instead of numbers. For example, Coach #8 often observes that clients who are only halfway their initial weight loss goal may be already satisfied, because they have more energy, sleep better and feel better. In line with this, Coach #1 states: *“Don’t look at the scale, look in the mirror. [...] It’s about how you feel.”*

Coaches also note that often a more profound issue is underlying the explicit goals the client initially presents. For example, bad self-esteem might be underlying a weight loss goal. As Coach #7 explains: *“The first impression is that someone wants to lose weight, but in my experience, it’s never about that. It’s really about somebody fighting something within themselves [...] So it is my role as a coach to understand which emotions are there, and to be sensitive.”*

Furthermore, the coaches indicate that client’s awareness of their personal health and behavior is considered as a valuable benefit of coaching. Coach #5: *“In my opinion, if a client didn’t achieve the weight loss, it can still be successful, because something changed in their awareness.”* Awareness about the impact of a certain diet or behavior on health is important to help clients make deliberate choices. Coach #3 strongly argues that coaching can still be successful when clients are choosing the unhealthy option sometimes, if they are aware of the impact and if their choice is deliberate.

When talking about monitoring progress, some coaches are concerned about clients being obsessed with the numbers. For example, Coach #1 states that long term perseverance is more likely when clients enjoy what they do, instead of focusing on, for example, speed or burned calories. On the other hand, quantitative measures can also positively influence the experience. Coach #7 explains: *“I have people who have such a bad self-esteem, or lost touch with reality of their bodies, that unless I can show them on paper, ‘look, you’re making progress!’ they won’t believe me.”* Coaches indicate that the effect of monitoring, either automatically or by keeping manual diaries, on their behavior and motivation, varies from client to client. For example, Coach #2 explains: *“Some people, when they see 8,000 steps on their activity tracker and know they have to reach 10,000, they will go for an extra walk to achieve their goal.”*

4.2.2. Theme III: The Value of a Personal (Human) Approach. All coaches emphasize the value of the relationship

between client and coach in order to be successful. For example, Coach #3 says: *“It is about the trust relationship between client and coach, which implies certain skills a coach should have: standing by someone, being open, not judgmental, providing safety, guiding someone, listening, being empathic.”* Many coaches report that the first consultation is aimed purely at building a relationship with the client and that this is a prerequisite to start working towards goals.

The role of social support of friends and family is also mentioned as a success factor. Coach #1 and #8 stress the value of a supporting spouse, and Coach #5 explains how effective it is when clients share their health goals with their colleagues and friends, to help them stay motivated.

Throughout all interviews, a personally tailored approach emerges as being important. All coaches state that what they do depends on the client. For example, Coach #2 explains: *“I’m always looking for the things that a client needs. What motivates, helps, triggers him, or maybe just reassures him at this moment?”* Notably, almost all coaches report they tailor intuitively and that the process of tailoring is hard to explain explicitly. However, further probing does reveal certain personal and situational characteristics they use in their tailoring. Personal characteristics include personal goals or problems, the client’s need for empathy (e.g., a strict approach versus ‘hand holding’), how motivated clients are, their base level (*“With some of my clients, I’m already happy if they’d eat one piece of fruit a day”* (Coach #9)), potential physical injuries or limitations, gender, age, profession and their place of residence (rural or urban). Situational characteristics are even more commonly mentioned by the coaches as tailoring aspects and are discussed separately in the next section (Theme III).

4.2.3. Theme III: Adapt the Advice to Situational Characteristics. All coaches stress the importance of adapting the advice to situational characteristics of the client. They try to make the advice very specific and fit it into the daily life of the client. Practical constraints like working night shifts, truck drivers who are on the road, or different cultural backgrounds are extensively discussed in consultation meetings to find feasible solutions. Even back-up plans are made, as Coach #5 illustrates: *“If a client plans to go for a run, but does not want to run in the rain, I suggest installing a weather-app and we discuss a back-up plan.”*

It may not always be easy to gain access to reliable information about a client’s daily life and behavior. The coaches mention common problem with clients

withholding information – simply because they don't know it is relevant, or to avoid shame.

Some coaches indicate that the client's context may often reveal highly relevant information about the client. For example, Coach #3 reports: *"consultations where a partner or parent joins gives me much more information. [...] Also, home visits are a very important source of information, seeing the kitchen and the fridge tells me a lot."* Coach #9 asks the clients to make a food journal: *"It says it all. Some people forget it, then you know they're not motivated, [...]. Some write very sloppy, others very tidy, including the times, others bring food to the consultation or make pictures. It's not only the information itself, but also the way it is presented, which is very informative."* Thus, examining the context of the client offers a rich source of information and helps to tailor the coaching process to the client's needs.

Not only external, practical barriers but also internal, personal barriers play a role in coaching. For example, the coaches report they must be sensitive to their client's stress levels in order to gauge their readiness to change behavior. Coach #2 explains: *"When there are big stressors like divorce or change of jobs, it is very hard to change behavior"*. Some coaches talk about 'the right moment' to make the change. Knowing barriers that impede adherence to the coaching plan helps to better understand and assist the client.

4.2.4. Theme IV: Motivation Is Important. All coaches report that for long-term behavior change, motivation is very important. First, reasonable expectations should be elicited; it makes a difference if clients realize that change is hard. Coach #8 and #9 report that they have had clients expecting them to be a magician and that just visiting them will initiate a change, not realizing that they need to change themselves. Second, being intrinsically motivated is indicated as key for success by all coaches. Some coaches indicate that clients who visit them because their doctor referred them (e.g., because of diabetes) are the most difficult to coach, because they do not come on their own initiative.

Although overall success is more than reaching explicit goals (see Theme I), all coaches emphasize that setting specific, measurable short-term goals is essential in providing success experiences, and thus motivation. Coach #7 compares the short-term goal "losing some body fat" with "losing 0.5% body fat". She described the power of making the goal very specific: *"[...] Next week, 0.5% done, high five, everybody happy, check off that goal. You see what I mean? [...] To the mental side, it makes a world of difference."* Not only measurable, also achievable goals are

important, as they increase self-efficacy. It is common practice for coaches to make gradual, step-by-step changes.

In order to keep clients motivated, it is very important to focus on (small) successes, and divert the attention away from inevitable stagnations or lapses in adherence. Coach #2 explains that this is especially important when dealing with clients who have low self-esteem, for example those who are binge-eating. Coach #6 often creates a personalized progress report for clients to make the success over the longer term visible.

4.3 Conclusion: Coaches' Reflections on Successful Coaching

The interviews demonstrate coaches' reflections on successful health coaching and the factors that may impact that process. Summarizing, health coaching is an interpersonal process that goes beyond measurable goals and activities. Goals and corresponding successes are often related to the client's experience rather than measurable behavior, and a good relation between client and coach is a prerequisite for successful coaching. The interviews also illustrate the importance of fitting the advice to situational characteristics: The more specific and tailored the advice, the more likely clients are to adhere to it. Tailoring shows to be an important aspect of successful coaching, yet coaches find it hard to formalize this process. Intrinsic motivation of the client is considered as a key success factor, and specific and achievable short-term goals help clients to stay motivated and increase self-efficacy.

5 STUDY 2: POTENTIAL ROLE OF TECHNOLOGY IN HEALTH COACHING

Purposely, we did not mention the role of technology explicitly in the interviews in Study 1. In elucidating the coaching process and its success factors, we did not want the results to be biased by coaches' perceptions on the capabilities of technology, or possible resistance against technology. In Study 2, as a follow up, we explored the potential role of technology in health coaching more explicitly. We used a focus group to explore coaches' perceptions and attitudes towards the use of technology as part of the coaching process. This method provides an additional advantage over interviews, in that the interaction between coaches may spark richer discussions and provide new insights.

5.1 Method

Four out of nine the interviewed health coaches participated in the focus group. The group consisted of a dietitian, two personal trainers and an online coach. The

session, held in autumn 2016, lasted 2 hours and was facilitated by the same researcher who conducted the interviews. The coaches received a small financial compensation for their participation.

The focus group started with a short ‘warming up’: a car navigation system was discussed as a metaphor for the potential role of technology. This was framed by the levels of automation per sub task as proposed by Parasuraman, Sheridan and Wickens [50]: information acquisition and analysis (e.g., road network, traffic congestion information), decision making (e.g., the driver is provided with route information while driving) and action (e.g., self-driving car, cruise control). The coaches were asked to apply the idea of such levels of automation on subtasks in health coaching. First, the coaches individually wrote down their thoughts for 10 minutes, after which a group discussion started. The group discussion was driven by the following questions, which were visible on a screen during the session. The facilitator refocused the attention to one these questions whenever the discussion was going off topic.

1. What can technology do for you? What do you need?
2. How would technology fit in your workflow?
3. What drawbacks of technology do you see?
4. On the allocation of tasks between you and technology: What do you prefer to do yourself, and which tasks do you prefer to outsource to technology?
5. Can you describe your new role, when assisted by technology?
6. Do you feel you have enough skills to work with technology?

The session was video-recorded and transcribed verbatim. Segments were selected when relevant to one of the themes ‘potential role of technology’ and ‘perception of, or attitude towards technology’. These segments were clustered in topics using thematic analysis [8] by two researchers.

5.2 Results

After the introduction a vivid discussion sparked easily among the coaches. The facilitator did not need to intervene often; all four coaches were open and willing to share their opinions and experiences. The facilitator only interrupted to give turn to other coaches, or to refocus the attention to one of the main questions. In the sections below the emerging themes are explained.

5.2.1. More and Better Quality Information. The coaches report a clear value of technology in providing them with more and better quality information. For example, Coach #B explains “*At the start I want to know many things, related to*

physical activity, nutrition, (...) and I only get half of that. (...) that would be something that technology can support me with.” Having access to objective information is helpful, as often there is a mismatch between reality and what people report. They do notice a need for tracking the *right* type of information; they doubt if this is always feasible. For example, often information on a client’s mental state and experiences is of interest, but not trivial to track.

5.2.2. Being Present 24/7 and Motivating Clients. The coaches indicate that technology can be helpful in being present 24/7 in order to motivate the client. Coach #C describes that with one of her clients: “*I don’t have the time to always be by his side. But then he would always be aware that he is actually doing well.*” Being present and sending motivational messages throughout the day can help clients stay motivated, according to the coaches, especially in cases when intrinsic motivation is lacking.

5.2.3. Support with Administrative Tasks. Another benefit of technology emerging from the focus group is support with administrative tasks, e.g., by automatically making notes during consultation meetings, or keep detailed track of exercises during workouts. Coach #D reports “*I try to avoid making notes as much as possible, because I always find it annoying (...) I think it would be valuable if notes could be made automatically, based on speech recognition.*” When the coaches are supported with their administrative tasks, they can focus more on the main role that they see for themselves: being there for the client, interacting with her, and through that, understanding her goals and experiences.

5.2.4. Interaction with the Client. Besides supporting with administrative tasks, technology could play a more proactive role in the interaction with the client, for example by detecting emotions, non-verbal cues and change talk. Coach #C explains: “*As a coach it is very important to notice change talk, for example ‘maybe I can’ or ‘I would like to’ and intervene immediately. Maybe an algorithm can help to detect change talk, for example my watch would vibrate, so I don’t miss these opportunities.*”

According to the coaches, interpreting and reflecting on the story of a client is a very important element of successful coaching, and not something that technology can, or should, do. For example, they report that it is very effective to connect a client’s goals to her values (e.g., being fit so you can play with your children), and as Coach #C explains: “*A computer couldn’t interpret this, and reflect, like: ‘I understand you’*”. Even in the case technology would be able to do this, the coaches think it will be more effective for a human coach to take this role. All coaches agreed that

a fully automated coaching solution would not sufficiently motivate clients. Coach #B reports: *“That personal touch is crucial, because only controlled by a computer... I myself would also be like: whatever. But if someone is looking, it’s different.”* Furthermore, the coaches express concern about losing skills by too much interference of technology in the process, e.g., being sensitive to cues of the client, and being alert and ready. Coach #C questions: *“What makes us humans unique? And what makes us sensitive to each other? And if we outsource that to technology... we lose a lot of human strength. That idea scares me.”*

5.2.5. Analysis of the Client’s Data. The coaches indicate that a structured use of a client’s data can help in the coaching process. Coach #C illustrates this with an example of a client who was often feeling faint during exercises. By structurally keeping a record she could pinpoint this to a certain type of exercise and was able to tailor the training sessions such that the problem was resolved. Also, the coaches see a benefit of using data for calculating realistic short-term goals based on the client’s history.

The coaches do not see much added value of relating the data of single clients to those of others, such as using data of a large group of clients to explore preferences and new opportunities for clients. When this topic emerged, Coach #C reported: *“Ok, maybe a database would be a good addition, but in the end of the day... You know, everyone is unique.”* She explains that, although a coach is expert on health, the client is expert on herself. With that perspective, coaches consider it their task to tune the coaching program to the client’s needs and possibilities and facilitate her in her own process. They do not feel technology could be sensitive enough to fulfill this serving and humble role, nor that additional information of other clients would improve this process. Another objection of the coaches against the idea of using data of other clients, is that this might lead to recommendations reinforcing current (potential unhealthy) behavior, instead of pushing a client slightly out of her comfort zone. They explain the fine line between engaging the client with activities that she enjoys, at the same time challenging her a little bit. Finding and keeping the right balance is a subtle and socially interactive process, and they do not trust the capabilities of technology in this regard.

5.2.6. Limitations of Data and Negative Psychological Effects. The coaches report that the use of (too much) technology may increase the risk that clients become obsessed by the data instead of listening to their bodies and enjoying the activity. The coaches state that tracking data encourages competition, whereas they feel that persistence of healthy behavior is related to joy of the activity. They consider

themselves to have an important role in both reminding the client to listen to her body, and in interpreting and making sense of the data. Coach #D explains: *“So I don’t believe in merely data. The question is, what do you do with the data, how do you give feedback, how do you interpret the data, how do you create insights from the data that the clients don’t see, (...), then it becomes interesting.”* The coaches stated that the effect of the data can be very different for different people, so it is the coaches’ task to carefully use the data and show it at the right moment and in the right way. Furthermore, they are skeptical about the existence of a ground truth on what constitutes healthy behavior, so having the data does not necessarily imply a straightforward interpretation.

Importantly, the coaches note an additional responsibility when confronted with (more) data. They are worried about their liability when serious issues remain unnoticed. With this perspective, more data is not always better; instead, it provides them with additional responsibilities, higher work load and potential stress.

5.3 Conclusion: Coaches’ Perspectives on Technology

The focus group results illustrate that coaches see the added value of technology mainly in having access to more reliable information about their clients’ health behavior, as well as in the opportunity to be a supporting presence in their clients’ lives. Furthermore, the coaches see benefits of technology to support them with several tasks in their practice, ranging from exercise logging to recognizing a client’s ‘change talk’ and calculating appropriate short-term goals.

The coaches also have a number of substantial reservations about the added value of technology on the coaching process. For one, coaches expect that an emphasis on data may foster obsessive behavior. Also, they think technology may not be sufficiently advanced to appropriately tailor its interventions to the individual client. Thus, they are skeptical about automatically generated recommendations or feedback, and feel that automated interventions that lack the involvement of a human coach will not be very effective. Furthermore, they worry about additional responsibilities on their part that may arise from being provided with (more) data.

6 STUDY 3: COACHES INTERACTING WITH DATA AND CLIENTS

Study 1 and Study 2 illustrate the complexity and social nature of the coaching process, and the challenges that may arise when introducing technology in the mix. As the first two studies did not allow coaches to actually gain some

firsthand experience with technology or data, we organized a workshop where a group of coaches interacted with two clients who brought their self-tracked health data. Interacting with possible artefacts could potentially reveal value that remains hidden when just talking about technology in hypothetical terms. For the purpose of comparison, half of the coaches were invited to interact directly with the clients, while the other half were asked to consult the self-tracked data only. Both groups independently formulated an advice. Afterwards, in a group discussion, the results were compared and the value of both sources of information was discussed.

6.1 Method

Twenty-one coaches (mostly personal trainers) volunteered to participate in a 1.5 hour workshop, embedded in a seminar targeted at employees of all Dutch student sports centers, in autumn 2016. Two clients, recruited by the authors, introduced themselves briefly (3 minutes each), explaining their goal and question to the coaches. Client #1 aimed to be stronger, and wondered why she remained stable, despite her fitness trainings and healthy diet. Client #2 had a hard time to keep up with her running trainings, while she aspired to run the half marathon.

After this introduction, 4 groups were formed. Five coaches were interacting with client #1, 5 coaches jointly consulted the data of client #1, 5 coaches were in interacting with client #2 and 6 coaches jointly consulted the data of client #2. In these parallel sessions (30 minutes each) the coaches were asked to formulate an advice for their client. Afterwards, a group discussion was initiated (40 minutes), where every group shared their insights and advice, and the differences between the groups and the added value of the tracking data and the interpersonal coach-client interactions were discussed.

Prior to the workshop, both clients wore a Jawbone UP3 for 2.5 weeks, which tracked their sleep, steps and resting heart rate. Additionally, client #1 wrote down her daily food intake. Client #2 brought the data of her TomTom Sports GPS watch, which contained all of her running and cycling trainings of over a year. This included training duration, distance, GPS information and heart rate. The coaches could assess the data via the standard interfaces of Jawbone and TomTom Sports, using provided laptops and tablets.

The parallel sessions and the group discussion were audio or video recorded and transcribed verbatim. In the analysis, segments were selected from the transcripts that related to either the value of human coaches, or the value of

technology and data. The segments were clustered by two researchers using thematic analysis [8].

6.2 Results

All parallel sessions showed vivid conversations, either with the client or about the data. Also the group discussion was lively, with active contributions from participants of all groups. In the next sections, the emerging topics will be described.

6.2.1. Emotional Background of Health Goals. Client #2 has had negative sport experiences when she was a child in school. She explains to the coaches: *“the education was like a push, you have to... and you’re graded for it.”* Her goal of running the half marathon originates from this background. However, she doesn’t like running, she enjoys cycling much more. For the coaches in dialog with the client, this is clear right away.

In the other parallel session, where coaches consult her data, the coaches only know from the introduction that she had a hard time keeping up her running trainings and aimed for the half marathon. Still, they interpret her underlying motives based on the data: *“I think she is looking for a thrill, because she goes into a very high heart rate zone and stays there for 20 or 25 minutes, and then suddenly it is over.”* Not only during the training session, but also from her daily routine, the coaches deduce something about her character: *“She’s just not in balance. She’s not moving there, that day only 5000 steps, and then the next day suddenly 18000 steps.”* And later: *“It fits with what she wants, she wants the endorphins, it seems like she is punishing herself for a lazy day, to compensate directly.”* Thus, the behavioral data and a sparse self-report in the introduction provide hints about the client’s background, motives and character.

When the individual groups share their findings in the shared group discussion, both groups report that the information of the other group is complementary to their own information. The coaches with data state that the story explains why the data is like this, and the coaches interacting with clients directly report it is interesting to see these emotional issues expressed in terms of behavior.

6.2.2. Understanding Beliefs. Client #1 has strong beliefs on what is healthy, and reports she bases her ideas about health on scientific literature she studies extensively. The coaches in dialog with the client are quickly aware of her beliefs and determination. They also talk about persuasive strategies that are likely to be effective: *“If we provide her scientific articles supporting our advice, then we will probably be much more likely to convince her.”* Similarly, in the other

parallel session, the coaches consulting the data of client #1 deduce from the data that she must have a determined and headstrong character. They report: *“She is just very structured. (...) She doesn’t change things in her diet nor in her training sessions.”* They advise the client to bring variation in her nutrition as well as in her trainings, and to be a bit less persistent in her attitude towards a healthy lifestyle.

6.2.3. Different Views on Actual Behavior. Access to practical facts of the client’s daily life is important to the coaches. Some are more easily accessible using data, others appear clearer for the coaches in dialog with the client. For example, client #1 went on holiday for one week in the period when she was tracking her behavior. This is obviously noted by the coaches consulting her data, but they draw the wrong conclusion: she might not work as hard as she reports. On the other hand, the coaches with data have access to much more detail on client #1’s diet. Therefore, they advise her to take the carbohydrate-rich meal *before* her training session instead of after, to increase the effectiveness of the training. The timing of this meal remains hidden for the coaches in dialog.

Additionally, client #2 has limited knowledge on training schemes; she declared to the coaches: *“I started running immediately 4 or 5 kilometers. At once.”* The coaches try to explain her about training zones based on heart rate, but that conversation stagnates because they lack detailed and accurate information of the training sessions. In the parallel session, the coaches consult the training-data of client #2 to understand her training style. Based on that, they advise a specific training scheme, even embedding it in the daily context of the client by inspecting a typical running track and adapting it on a very practical level: *“Here is a bridge, right? Then she can take a break there, and then go back.”*

6.3 Conclusion: Coaches Interacting with Technology

In the workshop, we set up two extreme situations: having access to a client’s data only, or interaction with the client only. This setup allows us to compare and contrast the added value of each source of information, separately and together. In line with insights from Study 1, the results of the workshop support the notion that goals can be ambiguous, and that there can be more profound issues underlying a client’s goal, which are required for the coaches to know in order to give suitable advice. The results show that direct interaction with a client is an effective way to unravel these issues in qualitative and experiential terms, through self-report on how clients feel and what they believe. On the other hand, the coaches

consulting the data discern most of these issues too, only in quantitative and behavioral terms. Having detailed information provides a good understanding of the actual behavior, and results in more specific advice, situated in the day-to-day context of the client.

Concluding, information is both hidden *and* revealed through behavioral data. Stand-alone data are not sufficient for effective coaching, yet at the same time, data provide additional insights that improves the understanding of the client. In the words of one of the coaches in the group discussion: *“Data help the coach to ask the right questions.”*

7 DISCUSSION

In health coaching, many technological tools (apps, trackers) are being developed and used to support end-users in meeting their health goals. In developing such tools, the coach’s role and perspective are rarely fully understood or well-represented. We believe that in order to develop successful e-coaching applications, we need to have a deeper appreciation of what constitutes a successful coaching process, which includes both the client and coach perspectives. In the current paper we aim to extend our understanding of the coach’s perspective on e-coaching technology, and the potential value that technology and (tracked) data may have in a successful coaching process and a productive coaching relationship.

Based on the interviews with health coaches in our first study, we conclude that health coaching is about understanding the client – both in terms of behavior and experience – and effectively anticipating on that. Inspired by the multi-channel telecommunication model [63], we depict this process as two communication channels between client and coach, one focused on behavioral data and one on the client’s lived experience, i.e., sharing stories, background and daily experiences (see Figure 1a). Our second and third study reveal that coaches see that technology has the potential to improve the understanding of the behavioral aspects of the client, i.e., by tracking and sharing data. At the same time, coaches emphasize the importance of having information about the client’s experience, and they believe that this is too subtle and ambiguous for technology to ‘understand’. As a result, coaches fear that incorporating technology into their coaching practice results in overemphasizing ‘objective’ and numerical information on measurable behavior, thereby discounting subjective experience and personal context, which would be detrimental to the coaching process (see Figure 1b). We will discuss these results in more detail below, and propose an intermediate

communication channel to bridge behavior and experience (see Figure 1c).

7.1 Technology Provides More Information on Behavior

In health coaching, information on health-related behaviors (e.g., nutrition, physical activity) is key for successful coaching. The coaches clearly recognize the value of technology giving them access to better and more reliable information about the training sessions and the client's daily behavior. This resonates with insights from the sports psychology domain where monitoring technology for athletes provides metrics that are helpful to plan and optimize training programs [9,25]. Also the workshop (Study 3) shows that interacting with detailed behavioral data is useful to get a richer and more precise view on the client's actual behaviors and routines, which may be less prone to errors than using a client's self-reported information.

Thus, technology can provide coaches with behavioral data, which is a valuable source of information to optimize the coaching process. Yet, the coaches are skeptical about automated normative interpretation of the client's behavioral data, because ground truth metrics on what is healthy behavior are lacking. Health data are inherently ambiguous; what might be good care for one patient under certain circumstances, can be sub-optimal for another [34,53].

The availability of, and focus on, behavioral data might impact the client and coaching process, in particular regarding motivation. The coaches state that progress feedback or automated motivational messages in between consultation meetings can potentially be helpful, for example in making small progress become visible. There is general support in literature that feedback from technology on behavior can be an effective way to change behavior [26,49]. At the same time, coaches in our study are aware of the potential drawbacks of (real time) feedback on clients' behavior and motivation. For example, they state that when clients are more focused on the feedback than on the joy of the activity itself, it easily undermines intrinsic motivation. As illustrated in Figure 1b, behavioral data get overemphasized, leaving the subjective experience underexposed. These insights resonate with controlled experiments demonstrating detrimental effects of external rewards [14] or even just the presence of self-tracked information [19] on intrinsic motivation.

Coaches in our study also express concern that their clients would become obsessed by the data. One's own

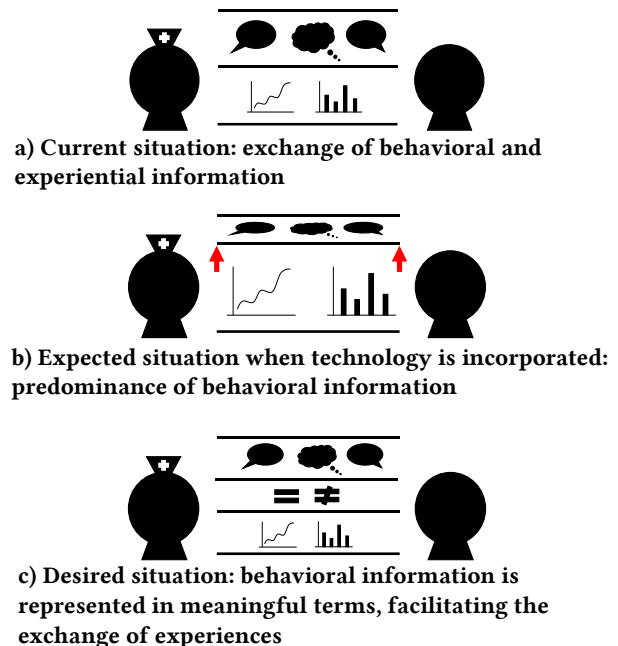


Figure 1: Conceptual model of impact of technology on coach-client communication

health data is shown to inherently have emotional connotations and provoke value judgements, including shame and obsession [3,13,49]. This means that behavioral data, in addition to inadequately representing experiential qualities, may even negatively influence that experience. Thus, as the effects of feedback on motivation are mixed, it requires a deeper understanding of the client to use it effectively, arguing for systems with a 'coach-in-the-loop'.

7.2 Coaching Beyond Behavior

For successful coaching, coaches highlight the importance of understanding the client's experiences, guiding the interpretation and use of behavioral data. The importance of experiential and relational aspects of the coaching process was emphasized time and again, serving a variety of goals, including understanding a client's implicit motivations, providing adequate social support, and helping someone overcome personal barriers.

Several studies in the field of Quantified Self share the idea that behavioral data are just a proxy of underlying experiences. The real value of self-tracking is often pointed out as a contextualized, subjective and social process [16,31,33,55], nicely illustrated by Rooksby, Rost, Morrison, and Chalmers who conceptualized the use of activity trackers as 'lived informatics': "Tracking was explained in terms of people's lives, worries, hopes, interests, careers and so on" ([55], p. 1171). At the same time, Lupton [38] highlights a tension, also present in our results, between

quantifiable data being perceived as more reliable on the one hand, whereas on the other hand “numbers alone tell us nothing, it is the context in which the numbers [...] are created that [is] important” (p. 6). Also for meaningful interpretation of health data among peers, context is essential for understanding [2,52].

Our results resonate with the related field of sports psychology, where coaching is frequently characterized as a complex and ambiguous process that is hard to capture through behavioral information alone [7,30]. To infer experiential information from behavioral information, substantial contextual information as well as social intelligence is required. Despite rapid advances in artificial intelligence and context-aware computing, creating socially intelligent systems is still one of the major challenges in the field [21,24]. Because the client’s behavior is relatively easy to measure, compared to the client’s experience, it is likely that behavioral information will predominate a coaching process supported by technology. This effect has also been observed in healthcare, where incorporating information technology involves the risk of focusing too much on measurable and predictable workflows, not acknowledging the flexible and fluid nature of the work [4,40], failing to capture emotional aspects [43], and sometimes even resulting in work-arounds to overcome constraints introduced by technology use [11].

7.3 Synergy between Behavioral and Experiential Information

Our workshop (Study 3) demonstrated that having access to behavioral data potentially facilitates the exchange of experiential information and enhances the relation between client and coach. The coaches reflect on the strength of combining data and personal interaction: “*Data help to ask the right questions.*” It provides access to the client’s context and experiences which otherwise might have been overlooked by the coaches. In this way, data can be a cue for interaction, potentially triggering new topics of conversation, or directing attention to underexplored aspects of behavior. This adds to studies in medical settings, where similarly the main value of patient-generated data is found to be a facilitator of collaborative reflection, supporting communication, mutual understanding and shared decision making [10,27,40,42,60].

To facilitate this synergy between behavior and experience in the coach-client interaction, it is important that information from the two channels are easily connected. Ideally, experiences should emerge intuitively from representations of behaviors. Therefore, we propose an intermediate communication channel (see Figure 1c),

where behavioral data is represented on a meaningful level. In the bottom channel, behavior on a lower, data-driven level is shared, for example, 1000 steps, 7 hours of sleep, 500 kcal. In the intermediate channel, data is aggregated and represented in a meaningful way, shifting it to information rather than data. For example, depending on temporal, locational, and other contextual information, 1000 steps could be construed as a ‘lunch walk’ or a ‘hospital visit’, or, 500 kcal as a ‘dinner with friends’ or a ‘dinner at home later than usual’. This behavioral, yet contextualized and meaningful chunks of information will more easily trigger interpretations at an experiential level in interaction with the client, e.g., ‘relaxing lunch walk with a colleague’ or ‘stressful hospital visit with my child’, providing the coach with a rich set of pointers accessing the client’s daily life, context, values and needs.

7.4 The Value of Ambiguity

An important question is, to what extent can and should technology interpret behavioral information, in order to facilitate the coaching process optimally? Context-aware computing makes a helpful distinction between contextual information of a particular behavior (the *who’s*, *where’s*, *when’s* and *what’s*) and the intention of that behavior (*why* the behavior has occurred) [15]. The contextual information is often not ambiguous. However, the *why* of the behavior, that is, the intention and meaning of the behavior to the client, remains ambiguous. A lunch walk might imply that the client was relaxed, but it can very well mean the opposite – in the case where she desperately needed a break on a stressful day. Thus, behavioral information remains ambiguous in terms of experience, and is therefore problematic to interpret automatically.

Ambiguity is not necessarily problematic. Gaver, Beaver and Benford [23] show that it may have value when things are left open for interpretation, as it reveals something about the identity, motivations and expectations of the interpreter. In the specific case of health data, it has been shown that the interpretation is colored by one’s own beliefs [34,38]. This does not have to be amiss; the ambiguity might actually comprise the value of using those data, as long as it can be used as a conversation topic in coaching [57]. Ambiguity, or stronger, inconsistency, has also been valued in *triangulation* [41], a methodological concept in social sciences. Triangulation describes the process where multiple sources of evidence are used to validate a claim, for example, using multiple methods, data sources or researchers. Mathison [41] states that, traditionally, we tend to strive for converging evidence, where all sources of evidence are leading to a single claim.

However, often evidence is inconsistent or contradictory, and this can actually be a valuable opportunity to learn. It invites the researcher to make sense of the differences, ending up with a more holistic view of the subject of interest and more valid claims [41].

7.5 Conclusion: Technology Supporting the Collaborative Coaching Process

In the complex and interpersonal process of health coaching, interpreting the client's behavior, i.e., talking about intentions and meanings of the behavior to the client, is a highly valuable activity in itself. Therefore, ambiguity make behavioral data useful. It is not possible, not required, and even stronger, it would be an unfortunate loss, to automate this task of interpretation. It would impede collaborative reflection and the enhancement of the coach-client relationship that is critical to success. Gaps and irregularities in the data, as well as situations where behavioral and experiential information are contradicting, are valuable starting points for effective coaching.

At the same time, presenting behavior in a meaningful way, easily triggering the recall of experiences, is an important facilitator of the collaborative coaching process. Along the lines of context-aware computing, the who's, where's, when's and what's provided by technology are *used* to determine why the behavior occurs [15]. Low-level data is often too distant from experiences to facilitate effective communication. The intermediate communication channel (see Figure 1c) aims at balancing between interpreting behavioral data on such a level that it optimally supports collaborative reflection and sharing experiences, at the same time, not restraining from the value of ambiguity of the behavioral data in this process.

Coaching is a social process, vigorously engaging both client and coach. As such, our focus on the coach's perspective provides only a partial view on the role and value of technology in health coaching. On the other hand, as argued in the beginning of this paper, previous literature mainly focusses on the client's perspective on technology in health coaching, leaving the coach's perspective underrepresented. Our results show that health coaching is all about the interaction between the client and the coach, and therefore, future work should focus on how technology influences and may effectively support these coach-client interactions.

Our results show that the coaches value support of technology in terms of having access to meaningful facts and figures on the client's behavior. At the same time, the coaches clearly emphasize that they want to be in the lead

when it comes to understanding the client and shaping the coaching process accordingly. Technologies in health coaching are often called *e-coaching* systems, giving the impression that these systems are aiming for replacing the coach, rather than supporting her. We conclude that in the coaching process, being a dynamic, contextualized and social activity, there is a unique and important role for the human coach. Technology potentially provides a valuable contribution, by informing and facilitating this process. By bringing meaningful information, yet accounting for the complexity and dynamics of the health coaching process, technology potentially promotes a better informed and more effective dialog, closer to the client's experience, and enhancing the relationship between the client and the coach.

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