Wearable Health Devices in the Workplace: The Importance of Habits to Sustain the Use

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***Abstract*—The use of wearable health devices, such as activity trackers or biosensors, offers great potential for managing one's health levels. Since they are affordable and widely available, organizations are also taking advantage of these systems (referred to as *physiolytics*), seeing an opportunity to handle some health-related challenges in the workplace. However, once physiolytics are implemented in the workspace, organizations face difficulties in sustaining employees' participation. This is a major problem because, to generate data that can contribute to personal health empowerment, physiolytics need to be used in a continuous manner. Habits are recognized as significant factors in determining sustained use of physiolytics, but there are no precise investigations on how organizations can have an impact on this matter. Because habits are highly context-dependent, organizations have the opportunity to create favorable conditions so that participating employees develop a *habituation* towards the use of physiolytics. Accordingly, in this paper, we conduct a narrative review to critically evaluate reported evidence and, then, formulate concrete propositions to support wearable health devices' habituation. We therefore aim to provide practitioners with upstream interventions to concretely help them in increasing the success of physiolytics' implementation as well as open the way for further investigations in this strand of research.**

Keywords—wearable health devices, physiolytics, habits, IS use, IS sustained use.

I. Introduction

Following the great success of low-priced sensors in private settings – known to many as the *Quantified Self* phenomenon – more and more organizations are investing in *wearable health devices* to either anticipate potential health and safety risks at work or respond to existing ones [1-4]. These systems, referred to as *physiolytics* [5], use machine-learning algorithms to process physiological and behavioral data (e.g. movement, pulse or heart rate) for generating analytical feedbacks. The rise of physiolytics in the workplace typically falls within the current era of workplace computerization [6, 7]. Organizations are keen to use smart systems to quantify the work environment and make use of metrics and performance indicators to provide targeted health initiatives to their employees [6]. Reports estimate 27,5 million wearable health devices will be introduced in workplace health programs by 2020, compared with only 166,000 units in 2013 [8, 9].

As a rule, organizations put major efforts in the implementation phase, to answer eventual ethical issues that some employees may have (see related literature:[2, 10-13]) and convince workers about physiolytics efficiency or ease of use. While they are achieving some good results in this area (e.g. [6, 14]), research also suggests that organizations often fail to maintain employees' participation [15-17]. Roughly half of the participating employees lose interest in physiolytics within the first months of use, possibly leaving this fast-growing technology without expressing its full potential. Yet, for organizations, these systems are valuable and effective when participants engage in a sustained use. In fact, such data generally need to be collected over time to (a) ensure that relevant information and feedback is displayed; (b) eventually increase employees' consciousness of possible health and safety threats (e.g. elevated stress levels or sedentary behaviors) and, in fine, (c) nudge them to engage towards better health behaviors and attitudes.

For this reason, scientists call for more active research on physiolytics sustained use, as well as for novel solutions to tackle these practical challenges [18].

Certainly, organizations cannot force employees to make use of wearable health devices, as privacy policies hinder organizations to establish a mandated use [12, 19, 20]. In the same vein, organizations cannot adapt much of the systems' design, as physiolytics are mostly introduced as off-the-shelf products [21]. However, they have the possibility to change organizational practices, norms, and routines to help participants to make use of the systems over time. In particular, recent research is starting to show that habits have a significant role in a quantified workplace, because data collection mainly goes through habitudinal routines [22]. This goes in line with current research on general (health-related or not) IS use, that are acknowledging the role of habits in organizational settings [23-28]. Alongside cognition-based factors (e.g. perceived usefulness, satisfaction, perceived ease of use etc.); use-related constructs such as experience and prior use [26]; emotions [29] or enjoyment [30], organizations are called to have a particular attention on habits, as they have an

important effect of observed IS use and thus constitute a major factor in the implementation success. In our case, habits, or *habituation* to systems (as some researchers refer to [31-33]), have a particular strong significance. We assume that employees taking part in these workplace health and safety programs have the intention to improve their well-being by using the systems. In this sense, a certain degree of intrinsic motivation exists. Habits are consequently critical because it might hook these people to continue using physiolytics and transform an intention of improving health into a lasting behavior. Hence, for organizations, a habituation to physiolytics mostly means a sustained use, thus increasing the value of the physiolytics approach.

Accordingly, we set out to explore the following research question:

RQ: What are the interventions that organizations can implement to support habituation to wearable health devices?

Building upon the prior work by Polites and Karahanna [28, 34], we investigate upstream interventions (i.e. optimizations of organizational structures [35]) that support the development of habits towards the systems, and consequently support the use. The underlying idea is to target practices, social norms or contextual specificities. By doing so, we seek to incite changes in attitude and to cement employees' intentions to use physiolytics in the long run. As a matter of fact, while habits are associated to the individual, they are context-dependent. To be functional, a habit has to operate in a particular setting where a behavior outside awareness can produce desired outcomes [28, 35]. One may therefore create new habits by altering the context to trigger new desired outcomes, with a particular attention that these new habits generate appealing outcomes for individuals; are easy to perform; and can be integrated into organizational shared routines [36].

To identify potential interventions, we conduct a comprehensive narrative review of the literature, following the guidelines defined by Paré, et al. [37]. Given that this matter has not been specifically investigated, we opt for a narrative literature review which allow us to (a) assemble various pieces of information into a readable format, (b) weight and critically evaluate a selected content and (c) create an educational document that brings practitioners up to date with practices and recommendations [38]. Such type of review typically helps to combine a new theory to a new context. It constitutes a first step in appraising current scientific evidence as well as evaluating the degree of potential it holds. It correspondingly paves the way to further, more systematical research.

The remainder of the paper is structured as follows. We briefly introduce the concepts of wearable health devices and habits. Then, we review the literature to highlight key learnings about habits in the quantified workplace and accordingly outline potential organizational interventions. Finally, we conclude by discussing the limitations of our analysis and the opportunities for future research.

II. Background

A. Physiolytics in the workplace

Wearable health devices (or physiolytics) can be defined as autonomous, non-invasive systems that track physiological indicators such as weight, sleep or exercise routines, in order to better understand individuals' habits or to improve health levels [11, 13, 39-42]. The term *wearable* refers to an essential attribute of those devices: portability. Their design needs to be adapted to a regular use, either directly supported by the human body or through a piece of clothing [41]. Therefore, comfort, functionality, practicality and attractiveness are some of the design prerequisites for their success [13, 41-44]. Wearable health devices are characterized by a variety of sizes and shapes, although they mainly come in the form of smartwatches, biosensors, activity trackers or wristbands [45, 46]. These also fall into two classes: device-centric or application-centric systems [47, 48]. Device-centric wearables refer to the capacity to function in self-reliance, in which they constitute the core unit of the tracking process and, eventually, gather mobile application(s) or computer programs structured around them (e.g. *Apple Watch*). On the other hand, application-centered devices are purposefully built around an application. They serve as a relay for the application, in order to record specific parameters such as movement, temperature or heart rate [48]. Connected wristbands or clothing constitute the emblematical examples of such devices (e.g. *Endomondo*).

Even though several ethical issues remain on an organizational level (e.g. repurposing of employees' physiological data for purposes other than health, or privacy and security risks [2, 13]), the integration of sensing technologies in workplace health programs is growing. The relative affordability of physiolytics paved the way for their diffusion inside corporate settings [40]. The development of these systems has also been propelled by further miniaturization, enhanced accuracy of health sensors, as well as the new capacity to automatically gather data about one's health and performance [13].

Wearable health devices embrace and support the realization of corporate health and safety objectives, such as increasing employee levels of physical activity, promoting positive lifestyles and assisting preventive interventions of health risks [9, 42]. Likewise, adding pleasure and interest to health promotion at work also constitutes a pursued goal by companies implementing this technology [17].

Nevertheless, as mentioned before, regulation regarding personal data protection hinders organizations to force their employees to use wearable health devices [19, 20]. Physiolytics at work may therefore create groups of users and non-users, with different levels of skepticism or trust issues, and disclose a wide range of user types (cynical, tech-independent..) that interact and cohabit in the workplace [39, 49].

B. Habits

Habits are defined as one's regular behavior, that has arisen from recurrently doing an action [35, 43, 50-53]. Such behavior, over a certain period of time, might be done unconsciously and as automatic motion. In fact, these

actions are initiated mechanically within a specific context (at certain time, at certain places) or/and in response to situational cues [28, 54, 55]. For instance, putting the seatbelt (action) right after entering in the car (contextual cue), or in a more workplace-related case (i.e. office), consulting mails (action) after turning on the computer at the start of the workday (context). Basically, once the trigger of the action has shifted to the situational cue, reliance on conscious awareness or motivational processes is diminished [54, 56, 57]. In consequence, habits are likely to prevail even after conscious motivation or interest dispels, especially in stable contexts [35, 54]. In short, they become one's learned response to a particular stimulus [35]. Eventually, habits are also beneficial on a cognitive level, given that some weight on mental resources are relieved (and can be redirected to other chores) due to the automation of the behavior [54, 57].

III. Narrative review

A. Study design

To extract all relevant information from the literature regarding habituation towards wearable health devices, we searched the bibliographic databases *IEEExplore*, *EBSCO Host*, *ACM Digital Library*, *Web of Science*, *PubMed* and *AISel* using the search string: *TITLE-ABSTR-KEY(wearable OR physiolytics OR self-tracking OR "self tracking" OR lifelog* OR quantified-self OR "quantified self" OR "activity sensing" OR "activity tracking" OR smartwatch* OR sensor*) AND TITLE-ABSTR-KEY(habit* OR routine).* We chose these platforms because they offer electronic access to multiple databases that reference a wide range of journals and conferences in the areas of computer science, medical informatics, and information systems. The search was done in November 2018 and was limited only to full peer-reviewed English publications. Additionally, the investigation was completed through a manual review of related terms and citations from references found in the database search. In order to gather and share information collected through this process, we first present the main determinants of habituation to physiolytics. Then, we synthetize research evidence to support habituation under distinct propositions and, lastly, report considerations on time and habit formation.

B. Main determinants of habituation to physiolytics

Literature first delineates the importance of the design and the functionality of these devices: they have to prove themselves in terms of accuracy, usability and portability [13, 16, 58]. The ability to use the systems at any time is crucial to integrate this new technology into existing routines. Likewise, the capacity to access the system and the data collected anywhere (and anytime) creates favorable conditions to maintain the use [15, 16]. Lastly, precise and well-designed feedback loops (i.e. recurrent feedback on performance) reinforce the potential to create a habit, as they help to monitor progress. Receiving a feedback on an attitude, behavior or action might therefore motivate individuals to perform it regularly (and by extension to wear the device).

Besides purely design considerations, related works notably underline social interaction, goal reinforcement and satisfaction as factors driving habituation [9, 51, 59-62]. In other words, it is suggested that sustainable use is linked to the capacity to create routines through pleasure, socialization and by giving meaning to the whole process. *Social ties* [63], may it be offline relations or online relations (enabled by social media and networking sites), help to work towards this habituation, as well as pleasure and satisfaction to discover, visualize and analyze personal biodata. Additionally, feedback loops and rewards aid individuals to experience continuous progress; potentially amplifying the engagement and, thus, the progress of building a new habit. As an illustration, in [61], authors provide developments on factors that help habitual use of an online platform (i.e. *Strava*) and their related wearables. The main results show strong impacts of self-regulatory and social motives for sustaining use. Finally, Pinder, et al. [51] elaborate on challenges of habit in designing digital behavior change interventions. Based on the synthesis of the *Dual Process Theory* [53], *modern habit theory* (e.g. [64, 65]) and *Goal Setting Theory* [66], authors propose a practical conceptual model, named *Habit Alteration Model* (HAM). This model notably presents the potentiality of altering context (e.g. changing the environment in order to trigger an intention or a response), goal priming (setting goal constructs or concepts in a stable context to drive a habituation), altering cue salience (reducing the salience of contextual cues for unwanted responses) or providing information (e.g. providing information to eliminate noise due to uncertainty). In line with this perspective, we bring together empirical evidence to formulate concrete interventions that organizations can implement to eventually influence habituation to physiolytics.

C. Upstream interventions for habituation to physiolytics

In order to maximize the chances of success of wearable health devices, organizations may undertake some specific initiatives to support habituation. As the decline in employees' engagement with physiolytics suggests, there is room to additionally motivate, encourage and help employees after the first use. The following propositions assemble empirically tested works, to create actionable recommendations.

- **Situational cues and priming can support habituation to physiolytics**.

Using a wearable health device is mostly an instrumental action [23, 25] that often only consists in putting on the given device. Reliance on contextual cues, can make this action easier to remember and support the development of an automatic attitude, that does not need much attention when performing it [54]. It is therefore important to identify situational cues that might help to generate an automatic behavior, especially as existing IS sustained use literature have not yet explored what these specific cues might be [23, 25]. In a work-related context, routine events (e.g. preparing the work material for the day, clocking in), locations (e.g. check-in desk), and meaningful objects (e.g. a device that workers use on a regular basis) might be used as contextual cues, triggering the action of using (i.e. putting on) a wearable health device. The idea resides in integrating an already established routine (not necessarily directly linked to health promotion and physiolytics) where employees can operate with the systems (think about them, put them, etc.), as well as linking them to a specific circumstance, easing the process of habituation.

Creating a habit is surely not an easy task to perform [54, 55, 57, 67, 68]. As specified in [54], the *initiation phase* (the

endeavor to build a habit) starts when the desired attitude and the context (in which it will be done) are chosen. The *learning phase* consists in a behavior repetition of the selected situation, to strengthen the context-behavior connection. For that reason, it is essential to pay attention to contextual workplace settings, identifying what suits the best for the given context. Reminders, such as notifications, might also be combined with situational cues, in order to participate to the reinforcement of the context-action association [69]. Habit formation ultimately ends with a *stability phase*, "at which the habit has formed and its strength has plateaued, so that it persists over time with minimal effort or deliberation" [54].

Some authors also refer to this practice (i.e. creating special cues to trigger an action) as *priming* (e.g. [51, 70]). Wryobeck and Chen [71] have highlighted the positive impact of priming techniques to facilitate health behaviors, such as exposing healthy life style terms (e.g. fit, athletic) or deliberately placing objects like walking shoes and runner's magazines to prime health lifestyles in people [70, 71]. In the same vein, displaying selected pictures may constitute situational cues and motivational mediums. In [72], authors placed an image representing a pair of eyes above an honesty box in a university coffee room to notify personnel to pay for drinks: the revenues collected after the intervention were higher than beforehand. Applicated to our case, displaying motivating messages about the importance of improving one's health behavior in a frequented area of the office – or, conversely, displaying warnings related to health issues (e.g. lack of physical activity, stress) may be some concrete examples of priming. Similarly, positioning motivational pictures (e.g. a person running) above the charger/on the desk may fall into this category. Although the illustrations discussed above are mainly based on sight; cues may also materialize in the form of locations, ambiences and even draw on sounds [51]. Tajadura-Jiménez, et al. [73], for instance, found positive results in changing participants' gait through a sound-based system that release beeps in reaction to user's walking patterns.

As briefly mentioned above, together with finding favorable contexts, specific stimulatory measures may be implemented to support the process of habituation to physiolytics in the workplace [67]. There is not only strong evidence that prompts and stimuli may have a positive impact on this matter [74] but they may also control unwanted habitual behaviors [51] and even help to a re-engagement after some prolonged inactivity [75].

- **Reminders can support habituation to physiolytics.**

Reminders, like notes, memory aids, notifications, e-mails or SMS, have been proven to positively increase user engagement and retention toward systems for health behavior change [64, 69, 75-77]. They constitute features that support behavioral repetition, by targeting frequency of usage or making existing behaviors more noticeable and comprehensible [75]. Research show that they particularly support participants in mitigating forgetfulness and in reminding them of their intention to perform the behavior [77]. In the workplace, employees have to handle cognitive solicitations that are demanding in resources. Reminders may help to unload this eventual weight in order to facilitate and support the use of physiolytics [78]. In an intervention that aimed to reduce sitting time among office-based workers [79], authors identified reminders and regular prompts to stand up as important means to break up sitting time. Establishing a reminder cycle regarding the use of physiolytics (e.g. via email, SMS) seems therefore to be a fairly efficient way to build a habituation towards them and help to create a positive environment for health improvement. In fact, even if the effect of the reminder decays over time, there is still a probability (if the person had executed the behavior sufficiently often) that the behavior has attained an habitual form [77].

- **Gamification can support habituation to physiolytics.**

Gamification is commonly understood as the use of game design elements in non-game contexts [80]. With a view to make systems' use more *fun* and enjoyable, gamification is an increasingly popular approach to keep users engaged over a sustained period of time [81]. Although gamification in the workplace is burgeoning, there is actually a lack of evidence related to long-term efficiency of gamification interventions in the process of habit formation [51, 74] and with the particular aim to sustain the use of wearable health devices [82, 83]. In fact, organizations experience diverse results in fostering users' engagement with a gamified IS. As an illustration, in [42], authors suggest that gamification of activities related to health in the workplace may become detrimental to themselves in the long term, whereas in [84], in a study of an online coaching application for flexible workers, it is indicated that gamification shows only potential in the long-term. This leads us to argue that gamification interventions for habituation have to be (a) highly perceptive of the context and (b) cautious in providing a constructive and positive game-based experience that is linked to the underlying non-game setting [85]. If we consider, for instance, the ludic and fun aspects that gamification may bring in the workplace: it may either create a positive activity sharing environment – through which group members build more engaging experiences (e.g. [86]) – or, on the opposite, it may be perceived as managerially-imposed games [87], with the impression that organizations are artificially pushing employees to feel the work experiences as more enjoyable [88]. According to [89], "play at work" is generally described as less enjoyable and less engaging because it comes with more frequent unpleasant experiences of being controlled [88, 89]. Therefore, a meaningful interaction corresponds to finding connections between employees' own interests and the system use. It may take the form of allowing employees to create their own fun rituals regarding the use or letting them to create/control their own goals. A meaningful interaction oftentimes leads to a meaningful engagement and it is therefore a good indicator for a deep engagement [90, 91]. To put it short, gamification has assuredly the potential to support habituation to physiolytics in the workplace; and evidence of a certain short-term effectiveness supports this assumption. The question still remains if these outcomes are be carried by a novelty effect – due to the curiosity and attractiveness that a new implemented technology potentially brings into the workplace [87, 92, 93]. Therefore, as regards habituation and sustained use, there is truly a need for qualitative and quantitative longitudinal

studies to further understand the role of gamification in users' habit formation. Nonetheless, this represents another challenge: wearable health devices tend to employ multiple gamification strategies, which make it difficult to determine why they succeed or fail [51].

- **Economic incentives can support habituation to physiolytics**.

Financial retributions have also been employed to create a habituation to wearable health devices [7] and to encourage healthy lifestyles in the workplace. There is nonetheless mixed evidence to support their effectiveness. Hunter, et al. [94] found no significant difference between control and intervention groups in terms of minutes of physical activity recorded (after 3 months and 6 months) in a workplace health program. Volpp, et al. [95], on the other hand, identified a success rate in the incentive group (during a program that was targeting smoking cessation among *General Electric* employees) and this rate persisted even after the financial incentives were discontinued (12 months later). All in all, as denoted in [16], most individuals are at least receptive to financial incentives from employers as regards using physiolytics. Still, there is room to argue that economic retributions create a haziness about their impact on habit formation. Given that the use might be engaged only due to the presence of the incentive, it may lead to a form of pushed and imposed physiolytics use. Accordingly, the development of a habit regarding the wearable health device (and the health improvement it may engender) may disappear as soon as the incentive is disengaged [4, 40, 69].

- **Including social components can support habituation to physiolytics.**

Social interaction may enhance participation (while using the device) by group dynamics, interactions through social networks and exchanges of experiences. However, it could also induce stress and tensions on the long run [11]. In fact, insistent and continuous quantification of health data and activity in the workplace may be counterproductive over time, although giving positive results on a short-term perspective [42]. Again, it is heavily context dependent (a high social connectivity could be a barrier in certain environments due to the presence of personal and sensible data), and echoes on the design of the intervention (what kind of data is shared with others and how employees perceive it). We argue that it is possible to unpack these social components and distinguish between (1) an enhanced social connectivity that echoes more to a "gamification" context (e.g. social networks or online leaderboards) and (2) group dynamics, individuals' opinions; teammates' experiences, peers' feedback or superior influences, in creating use dynamics. For instance, some may react favorably to the recommendation of a friend about using a wearable health device, but at the same time, be reluctant to participate in a corporate-wide, steps-in-a-day contest. Same goes in the other way, with some employees being more motivated by the contest. Still, early evidence suggests that group dynamics in the workplace have a more positive influence towards habituation. In [42], a team captain gave a chocolate a day to every team-member who reached 10.000 steps; these internal competitions became so significant to the participants, that it stuck their participation and became sometimes even more important than the general goal of the campaign (increasing physical activity via a step counting).

- **Monitoring employees' levels of satisfaction can support habituation to physiolytics.**

Satisfaction is another influencing factor on habituation to physiolytics. By appreciating the use of the wearable, the advantages and the benefits of it; employees decide to continue employing the technology and, as the practice accrues, employ it with more ease [96]. The deliberate thinking dissipates (since they appreciate it) and it opens the way for a more automatic behavior. It is essential to denote that satisfaction and enjoyment entail different mechanisms regarding sustained use. Satisfaction corresponds to an appreciation of the experience and the circumstances attached to it. Enjoyment and pleasure fall directly into emotions. For instance, we can experience pleasure with a product or a service, while not being satisfied with it (if it does not match our expectations or requirements) [97, 98]. Moreover, we postulate that they may differ over time: the sentiment of joy may be more prevalent and important in a short-term perspective, but, as the time passes, lose intensity and importance concerning continuance. Enjoyment typically may overlap with the novelty effect, where high rates of use may be experienced in the early stages, due to the interest in the new implemented equipment [91, 98]. From this perspective, sustaining the use of physiolytics in the workplace means as well overcoming employees' curiosity. Consistent with this, we suppose that satisfaction corresponds to a mechanism that deploys on a longer perspective. In all cases, satisfaction and enjoyment with wearable health devices develop according to the extent to which employees use the devices. Organizations have therefore to be attentive to their employees and offer an environment that is suitable to the maintenance of enjoyment and (especially) satisfaction with the wearable health device (and, by extension, with the related workplace health program). Typically, questionnaires or discussion sessions may be conducted along these programs, in order to document the degree of satisfaction, overcome eventual issues and refine the likelihoods of sustained use.

D. Time dimensions and habituation to physiolytics

To conclude, we reflect on how organizations may locate and trace the impact of their eventual interventions to support habituation to wearable health devices. If we investigate the process of habit formation in everyday life, 95 percent of the time, a daily repeated behavior needs from 18 to 254 days to translate into a form of automaticity [99]. Even though the variation is substantial at an individual level, the median time to form a habit consists of 66 days [57, 99]. Estimating and defining if a repeated behavior has converted into a lasting habit (and how long it has taken) is therefore a difficult task. Rather than engaging in such an undertaking, research has mainly focused in examining and recording the changes over time, to determine if an intervention has created a change in the habitual behavior [51, 100]. In consequence, longitudinal studies are critical, given that sustained use cannot be grasped by a snapshot in time. Plus, IS sustained use is hardly predictable [24]. It is by definition a continuing process, whereof follow-up

interventions enable accurate measurements. For this purpose, and in order to assess attitudes and behaviors that possibly take place outside an individual's awareness, observational studies seem to be more appropriate than self-report techniques [23]. That being said, even planning a single follow-up after the main intervention is valuable in the context of physiolytics. It provides an early consideration of the degree of behavior change over time and informs about how physiolytics have infused in the environment [82, 101, 102]. The workplace is precisely an environment that offers the advantage to be relatively stable: a behavior can be performed regularly given that individuals ordinarily spend a certain amount of their day time in there. It is consequently an ideal venue to implement positive behaviors, but also to address health issues in the greater community and monitor eventual changes over time. In that respect, achieving a habituation to physiolytics may lead to a better health lifestyle in employees. And, we argue that it may also transfer to their health habits in personal lives, since workplace attitudes have the potential to transfer from workplace to home life [103].

IV. Synthesis and Discussion

By presenting habits as key factors for sustained use of wearable health devices, our aim has been to generate a deeper understanding of this matter. We illustrate what it takes for organizations to better reflect and intervene on habituation. Physiolytics and their organizational implementation are at an early stage of development, in which collecting evidence for relevant stakeholders (such as management professionals) is of particular importance. Organizations have true opportunities to create favorable conditions to cement the use of physiolytics, in order that it creates value for employees and the organization. Through habit formation (and its related components, such as situational cues, reminders, financial gratifications or gamification), organizations are in position to explore new ways of sustaining the use of physiolytics and maintaining active participation from their employees (see *Fig. 1*). They do not have any more to solely rely on the design of the systems (in terms of usability or accuracy of feedback) or on cognitive models (more focused on the acceptance and adoption of physiolytics), but they can actively work on generating advantageous environments for physiolytics use. Although employees' long-term engagement with wearable health devices are not guarantors for a positive outcome for organizations, it is certainly antecedent for it. It constitutes a clear objective that organizations can aim and a tangible element in the evaluation of the viability of physiolytics in the workplace.

Furthermore, situational cues, priming or other incentives, stimuli and positive reinforcements share a common mission: they all help to remove barriers in terms of complexity, annoyance or displeasure in using the system over time, to engender a habituation towards wearable health devices. A more comprehensive use (e.g. by giving known references to employees to evaluate their progress) may lead to a more habitual use. Same goes for a more frequent use (e.g. supported by well-defined reminders) that may create a habitual use [24]. The addition and mix of these features and components, if well-designed, may maximize the chances to reach this habituation.

However, longitudinal studies are needed for measuring the degree of habituation to wearable health devices. It appears difficult to claim that a behavior has reached the status of habit, but its observation over time offers the possibility to grasp how the behavior has developed and at what degree it has infused in the environment. Also, there is a necessity to think of approaches on how to accompany the introduction and sustained use of this technology. Most critically, wearables health devices need to fit *smoothly* into existing routines at the workplace. Since the scenarios are not the same across organizations, taking in account the context leads to a better comprehension of the possibilities, limitations and effects of physiolytics [67]. For studying this, we believe that the adoption of a multidisciplinary perspective is required. Assessing long-term engagement regarding physiolytics implies to give attention to behavioral studies, activity theories and many other psychological and social outlooks [23].

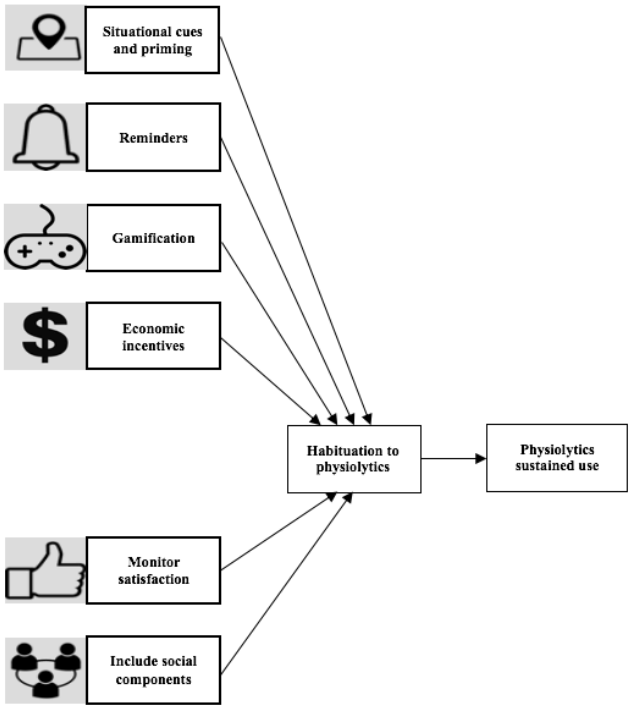

Fig. 1. Upstream interventions to support habituation to physiolytics

V. Limitations and Opportunities for Future Work

Even though reasoned actions and emotional responses are more linked to adoption and acceptance of physiolytics in the workplace, they still play a role in the post-adoptive phase and potentially affect automatic use. Aspects such as self-regulatory motives, user motivation, autonomy, self-growth or excellence through the use of technology have therefore to be considered in habituation to physiolytics – to form a comprehensive picture of physiolytics sustained use. For instance, users' intrinsic motivations and autonomy have to be supported in order to maintain wearable health devices' use [104]: these elements also impact strategies that an organization may implement to create habits towards these systems. For that purpose, investigations and research that are more centered on employees (e.g. qualitative assessment of their sustained

use behavior) may be particularly suitable to unveil the significance of these aspects in the process of habituation and sustained use.

Next, on an organizational level, further stimulatory reinforcement measures may be explored. To complete our first outline on habits, mechanisms based on "commitment" (e.g. participants pre-commit in writing that they will participate in the company's health and safety program and use wearable health devices) or on "providing customized information" (e.g. via a preliminary questionnaire) may help to provide a tailored action plan regarding the use of physiolytics. They arguably also target habit formation with a view to sustain the participation in such workplace health programs.

Moreover, this study corresponds to an initial analysis that aims to pave the way for further investigation in this strand of research. Therefore, propositions that can be extracted from this work are not tested in practice. This mechanically opens opportunities to build testable hypotheses and then, consider them in interventions to gather empirical data. As discussed in the previous section, longitudinal studies should be largely prioritized. In the same vein, it is necessary to unveil the signification of certain concepts (e.g. social components, satisfaction). In fact, we have defined some big lines and offered practical directions for practitioners and research; but there is still a need for more refined/structured models that can be tested (in diverse contexts) and that provide specific answers to habit formation in the wild.

Finally, it seems important to provide developments on the "unpredictability" of habit formation. Interventions, which claim to support habituation (e.g. through incentives) do not certainly yield to habit creation. In fact, upstream interventions presented in this paper have to be apprehended as tools that help to reach an automatic use (faster), and not as guarantees of infallible results. We are dealing with a behavior that results from actions performed without conscious, perceptual or judgmental process [24, 25], on which we are applying rational constructs (i.e. upstream interventions). We should consequently be aware that it is insufficient to consider it as foolproof schemes that deliver habits. Likewise, interventions on habits may generate adverse impacts. If made in the wrong context; at the wrong time; according to a rigid reinforcement schedule or with the wrong reward, it may accidentally strengthen undesirable behaviors or hinder from habit creation [51].

In sum, we are still at an early stage of a thorough comprehension of physiolytics sustained use. This offers many interesting opportunities for potential research from various epistemological perspectives, may it be design-oriented research for improving the interaction and utility for users, positivist research that helps to better comprehend acceptance and resistance, or critical research that creates some awareness about ethical perils of physiolytics in the workplace setting. Practitioners are also given opportunities to be active in the implementation of physiolytics. By changing practices, norms or routines, they can increase the chances of a sustained use of the systems; thus, increasing the value of the physiolytics approach and tackling a recurring issue in practice. Hence, through our work on habituation to physiolytics, we aim to illustrate what these opportunities are, and how we may, through another perspective, better understand and impact physiolytics use.

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