

## Designerly solutions for vital people

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Inaugural lecture  
Prof.dr. Steven Vos  
October 7, 2016



/ Department of Industrial Design

**TU** e

Technische Universiteit  
**Eindhoven**  
University of Technology

# Designerly solutions for vital people

Where innovation starts

Inaugural lecture prof.dr. Steven Vos

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# Designerly solutions for vital people

Presented on October 7, 2016  
at Eindhoven University of Technology



## Prologue – Setting the scene

*“Research on leisure time sports and vitality at a university of technology may not be evident at first glance, it contributes to an active and vital society.”*

Once upon a time there was a little boy living in a quiet village surrounded by fields, meadows and woods. Although his parents were not active in sports, they were active workers and encouraged him to be physically active, to play outside and to enjoy the opportunities provided by the nice outdoor landscape. At the age of 5 he joined a football team. Though he was not the most talented player on the field, he enjoyed the game and he showed drive, motivation and determination. In these early days of his life, he even managed to win the (very) local netball championships with a group of class mates, he participated in occasional outdoor *futsal* competitions and was an active member of a youth movement, where young people take part in outdoor activities. The social aspects of these (sports) activities, the social support, the competition and the playfulness of these activities were his main drivers to participate.

Unfortunately, as a teenager he stopped playing football, and his sports activity was limited to a minimum during his student days in a medium sized university city. An occasional bike ride, a short run and a weekly indoor futsal game became his ‘active’ compensation for a merely sedentary working life as a researcher. Becoming involved in sport sciences and a father of two younger boys in his thirties, he became more and more aware of the importance of an active and healthy lifestyle. However, the key question was and still is: how to get this integrated in a busy 24/7 economy? How to deal with the challenge to find the balance between family, work, friends, sleep and sports? How to get and stay motivated practicing sports in a flexible way, independent of time and place, without the support of a rather strict organized sports framework? How to enjoy again those drivers which involved him in sports in his early childhood days, such as the social support, the competition, the playfulness, ...? Can ICT and technology, which in part stimulated his sedentary behavior, be a game changer for this?

Today, more questions remain than before. This short story started with the words 'once upon a time', which is some kind of a fixed opening line used in fairy tales, folk tales and fables. Most of these stories end with another famous sentence, namely 'and they all lived happily ever after'. Although I'm not a clairvoyant, I hope this story will end with the sentence 'and he and his family had a healthy and active life ever after.'

In this inaugural lecture, set up as some kind of a scientific bike race with a prologue and 5 stages, I would like to share with you my vision on the key role of leisure time sports, physical activity and vitality in society, and the unique assets of industrial design to contribute to this. I would like to analyze the introductory story, which is about the major health issues deriving from physical inactivity, and the individual quest for a solution. I will share my perceptions and perspectives on research and education with you, especially within the creativity and the designerly power of the Department of Industrial Design at Eindhoven University of Technology.

Research on leisure time sports and vitality at a university of technology may not be evident on a first glance, but has a potential contribution for an active and vital society.

# Stage I – Conceptualization

*“Leisure time sports hold some key elements which are crucial for a sustainable change of behavior with regard to physical activity and health.”*

In this lecture I will frequently use terms such as leisure time sports and physical activity. These concepts are rather broad and require some explanation. Traditionally, a distinction is made between sports and physical activity. A considerable number of scholars even considers them as two dichotomous concepts. Hence, I will first focus on the conceptualization of sports (see Figure 1). Next, I will explain how I see the relationship between sports and physical activity in my chair.

In my research the focus will be mainly on active participation in leisure time sports or mass sports. This includes both performance sports and recreational, participation sports. While the first refers to result-driven sports practices, with a focus on competing and following an exclusionary logic, the latter puts emphasis on taking part, pleasure and has an inclusionary logic (Scheerder et al., 2011; Vos, 2012).

Performance sports and participation sports, being opposite to each other, are the two ends of a continuum (Scheerder et al., 2011). Both can be practiced in different settings. However, it has to be said that in recent decades, there has been a general development from organized sports activities towards more

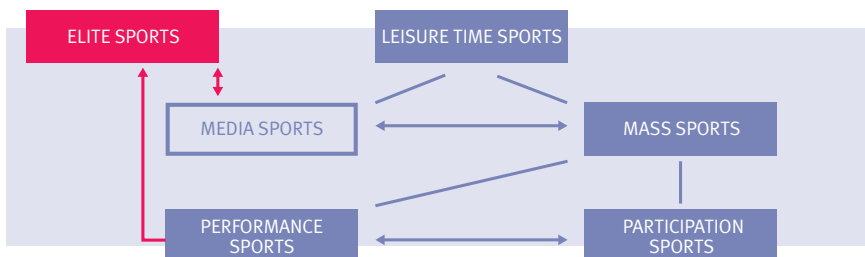


Figure 1

Conceptualization of leisure time sports – modes of sports participation

Source: Adaptation of Scheerder et al. (2011)

recreational and unorganized and lighter forms of sports, such as running, cycling, recreational walking and fitness (e.g., Borgers, Scheerder & Vos, 2015; Scheerder & Vos, 2011, Scheerder, Vos & Taks, 2011).

Elite sports will be out of the scope of my research as it has other perspectives and requires a completely different approach, compared to leisure time sports. Moreover, I strongly believe that the principles, drivers, experiences of elite sports and leisure time sports are not only different but may also conflict. Although a considerable number of scholars have criticized the traditional pyramid model of sports (e.g., Eichberg, 2008; Palm, 1991; Renson, 1983; Scheerder et al., 2011), there is still a general belief that elite sports and mass sports are directly connected and that the former has a positive effect on the latter. It is obvious that while there is a connection between both, they require a distinctive approach and envisioning of societal and personal needs as well as different design approaches (Vos et al., 2016). For instance, the group of mass sport participants is more heterogeneous: whereas elite athletes are well trained on a very regular basis, recreational sport participants can be anything between well trained and barely able to partake in sports.

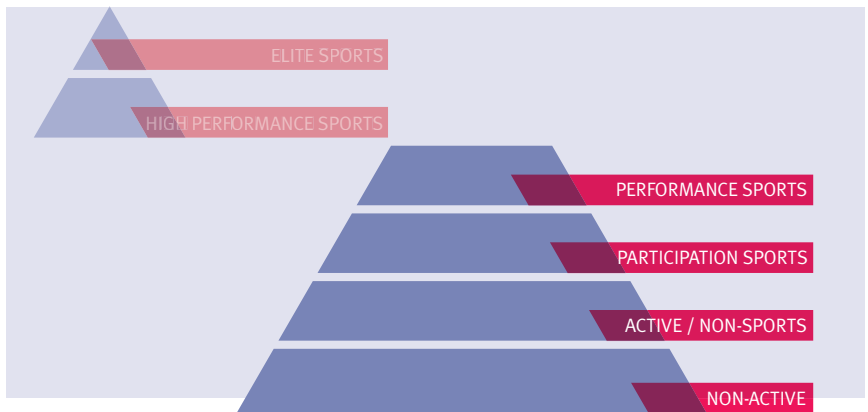


Figure 2

Conceptualization of the research domain of leisure time sports and physical activity – the illusion of the traditional pyramid model of sports!?

We believe that the traditional pyramid model of sports should be split into two sub-pyramids, whereas the pyramid on the right-hand side of Figure 2, reflects the field of research of my chair, connecting mass sports with physical activity and non-activity. This figure bears some resemblance to the Extended Church Model of



Sports by Scheerder and Vos (Scheerder et al., 2011; Scheerder & Vos, 2013). Physical activity and physical inactivity are the two basic layers of this pyramid. Although they also have different backgrounds and motivations, we believe they are strongly connected. In my research I consider being (sports) active and feeling (sports) active as two senses of a vital lifestyle.

The two sub-pyramids in Figure 2 represent two different societal questions which require two different solutions and fields of research. At a system level both 'domains' can benefit from each other. I will go into more depth on this later in this lecture.

## Stage II – Societal changes, challenges and chances

*“Our society is changing, physical inactivity is becoming a major challenge and designerly solutions could create chances.”*

A considerable number of socio-cultural developments have changed our society and, hence, our sports and physical activity patterns. Among others, trends such as individualization, digitalization, medicalization, quantification and technologization, have a significant impact on our daily lives and our sports and physical activity patterns (e.g., Brombacher & Vos, 2015; Scheerder et al., 2011; Vos et al., 2014). For instance, traditional institutions (such as sports clubs) are replaced by self-directed ways of living and virtual networks (Scheerder et al., 2011).

Industrial and technological developments, which are expressions of the transformation from traditional societies into modern ones, enable us to have a high level of comfort and to focus on efficiency. The world in which we live, work and play is increasingly influenced by innovations, smart services and products. Data-driven algorithms drive decision-making and the focus is on aspects such as health, self-reliance, safety and efficiency (van Hooijdonk, 2015). These developments have become part of life's routine. While technological developments have improved our quality of life and comfort, they have created serious downsides concerning our health and well-being (Peeters & Megens, 2014). For instance, our mobility has shifted from active transport (i.e., walking and cycling) to (efficient) transport by car.

Indeed, our society is facing a noticeable increase in sedentary behavior and physical inactivity. Physical inactivity, in addition to the extensive intake of food, is a growing public health concern (e.g., WHO, 2016). There is a strong relationship with a rise in non-communicable diseases (e.g., Blair, 2009; Blair et al., 1989; Chakravarty et al., 2012; Garber et al., 2011). As a consequence, major health related issues occur, such as a low quality of life, health inequalities, substantial healthcare costs, attributable mortality, etcetera (e.g., Blair, 2009; Ding et al., 2016; Kohl et al., 2012; Lee, Folsom & Blair, 2003; van der Ploeg et al., 2012). In addition, sedentary behaviors have become evident in our daily lives. Excessive

sitting (at school, at work places, at home viewing TV, etcetera) has become highly prevalent and is causing additional health risks (e.g., Ekelund et al., 2016; Matthews et al., 2008; Wilmot et al., 2012).

Our current 24/7 economy puts constant pressure on a healthy and active lifestyle. Each individual has to keep different balls in the air (family, work, social life, leisure time, etcetera), and a considerable number of adults sees their lack of sports and physical activity as a personal failure (see Figure 3). Personal ‘let-downs’ are interpreted as personal failures in their search for self-development. Their default answer to the question ‘How are you doing?’ is ‘Busy, busy, busy!’. Signs of ‘need to be active’ stress seem to occur, while being active also could be fun, enjoyable and relaxing. This clearly is a pressing problem of our 24/7 economy which is in search of a solution.

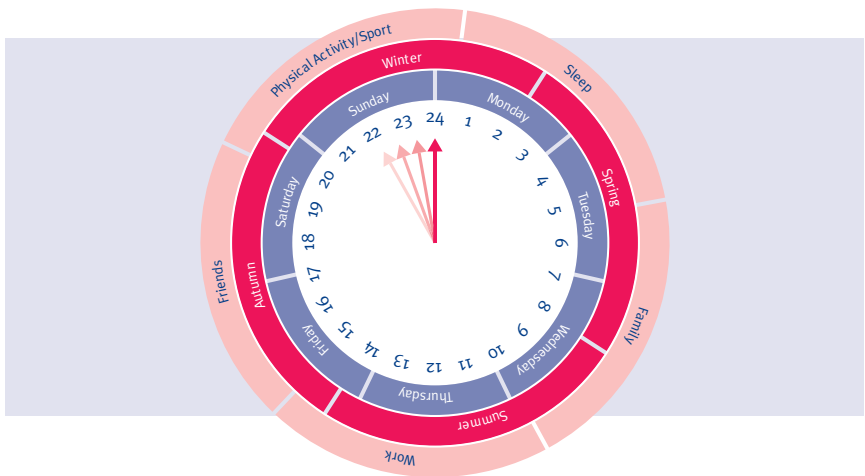


Figure 3

The struggle to find a PA-life balance in a 24/7 economy

The urgency for effective interventions is strengthened by the observation that physical activity is not improving worldwide, notwithstanding a considerable number of policies and interventions (e.g., Das & Horton, 2016; Reis et al., 2016; Sallis et al., 2016a). Moreover, despite the fact that scholars emphasize the role of physical activity in preventing diseases and reducing mortality, these and other health related arguments seem to be inadequate to convince large groups of people to keep being more physically active (Vos et al., 2016). Yet, incentives such as social interaction, competition, play and fun (cf. the homo Ludens, Huizinga, 1955), which can be considered as important elements in society and drivers for

involvement in leisure time sports, could have a crucial role in this. Indeed, in recent decades, there has been an exponential growth of individual or unorganized leisure time sports with an increase in the significance of a slim and healthy fashioned body (e.g., Borgers et al., 2016; Scheerder et al., 2011; Scheerder & Vos, 2011). This development is enforced by an increased diversity of sports on offer and opportunities, creating flexibility for people to combine their (individual) sports with work and family life. Hence, the thresholds and barriers to get involved in sports are lessening more and more. People can choose their own way of being involved in sports, compatible with their own individual lifestyle and consistent with their own interests (Scheerder et al., 2011). The Homo Sapiens has evolved from Homo Faber and Homo Ludens (Huizinga, 1955), to Homo Technologicus (Gringas, 2005), and Homo Optionis (Beck & Beck-Gernsheim, 1996).

Yet, in this do-it-yourself trend with a low threshold, there is a lack of social support and coaching by trained experts. For less experienced sport participants this often results in high drop-out rates due to injuries, lack of motivation and other constraints. Indeed, it is not only about becoming (sports) active, but merely about staying active.

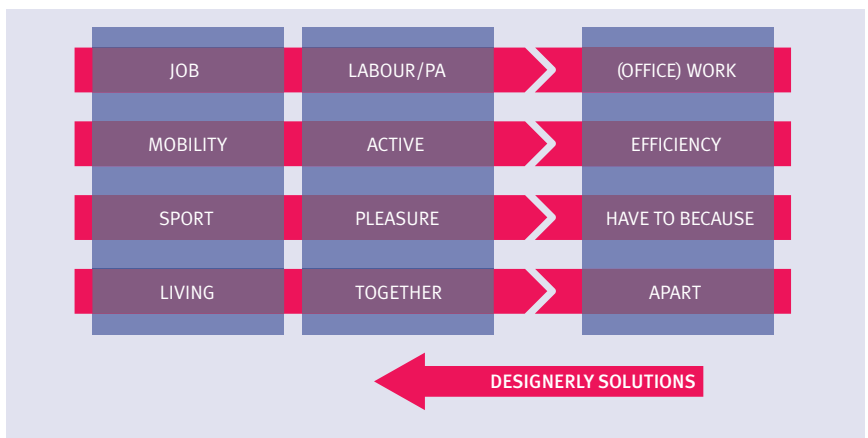


Figure 4

Four societal C's looking for designerly solutions

Figure 4 displays four societal C's or application areas I will address in my research. First, people spent a considerable part of their day at work. Our jobs have evolved from active labor to merely sedentary office work, due to technological developments such as computers, internet, smart phones, robots,

etcetera. Second, efficient transport has taken over the role of active mobility. Indeed, our mobility has shifted from transport by walking and cycling towards transport by car. Third, in our 24/7 economy traditional values of sports such as competition, fun and pleasure have shifted to 'have to because'. Intrinsic values are suppressed by extrinsic values which have a limited motivational value for sustainable behavior change. Fourth, our society has shifted from an organized and group approach (cf. together), to an individualized society where social structures are limited and social support is lacking.

I will focus my effort on the development of designerly solutions (cf. intelligent systems) that can transform these changes and challenges with regard to physical activity, vitality and leisure time sports towards chances.

## Stage III – Intelligent systems – solutions for problems!?

*“Intelligent systems have the potential to contribute to the reduction of physical inactivity. However, this requires a distinctive approach and envisioning of societal and personal needs.”*

In the last five to ten years, developments in ICT and sensor technology have resulted in a wide range of ‘technological gadgets’ such as health related smartphone applications, activity trackers and sports watches (e.g., Dallinga et al., 2016; Fanning et al., 2011; Middelweerd, et al., 2014). These reasonably advanced products are currently quite popular among both experienced and less or inexperienced recreational sports participants. For example, in 2014 there were already over 30 thousand apps in the health and fitness categories of iTunes and Google Play (Yuan et al., 2015). Yet, due to this health-related technological devices boom, it becomes difficult for people to see the wood for the trees (see Figure 5).

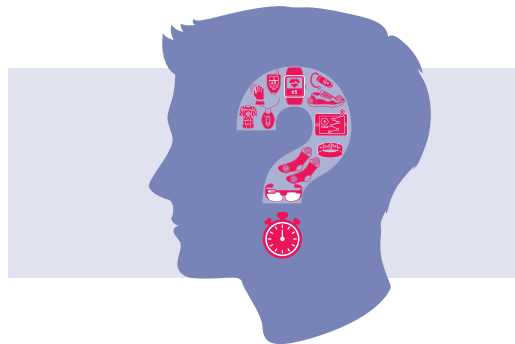


Figure 5

Wearables and apps: people do not see the wood for the trees

Low-cost, personalized and context-aware (health) technologies are likely to dramatically improve personal health outcomes as they offer possibilities for early detection and monitoring of (chronic) diseases, remote care and self-management. Moreover, they have created new opportunities for both leisure time sports and physical activity (Vos, 2016).

These innovations in smart wearable body sensors have created possibilities for people to become ‘experts’ in self-monitoring of health parameters and physical activity, on a 24/7 basis (Brombacher & Vos, 2015; Vos et al., 2016). This is consistent with a more general trend of self-monitoring health outcomes, often referred to as Quantified Self (Swan, 2012). This wearable sensors boom has resulted in several application areas. Smartphones, introduced in the market about a decade ago, and wearable devices are important carriers of this development. In addition to smartphones and wearable devices, such as watches and bands, other forms of smart and wearable sensors are appearing, such as smart clothing, eyewear and others (see Figure 6). For instance, heart rates can be measured not only via heart rate monitors with chest straps but also via optical wristbands, biometric headphones and smart monitoring clothing, etcetera.

One of the game changers in these recent advances in technology is their ability to track behaviors in daily life situations over time, and across a large number of users. The capturing of temporally, behaviorally and ecologically contextualized data from their users generates large datasets. Trend and pattern analysis (i.e., data science) creates more understanding about the correlations and associations between individual, social and environmental factors and physical activity and health as well as other aspects of life, such as wellbeing (see for example Westerink, 2016).

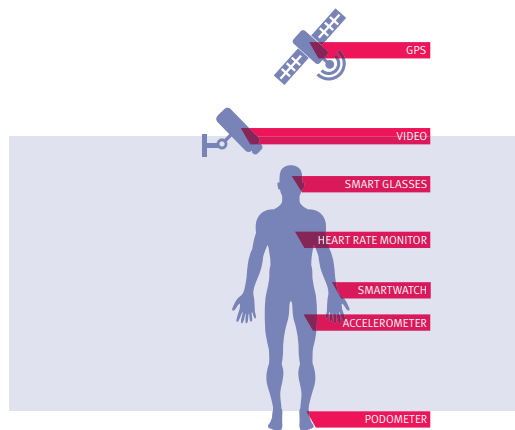


Figure 6

24/7 monitoring of behavior – the connected individual

There is no doubt that smart wearable sensor solutions, and other recent advances in technology, have the potential to contribute to the reduction of

physical inactivity. These systems, for instance, can adapt towards their users and their context and can provide new ways of interaction (Peeters & Megens, 2014). Notwithstanding these enormous opportunities for the domain of leisure time sports and physical activity, there are many design challenges that need to be tackled. Yet, currently, the underlying data models and design propositions are mainly based upon concepts directly derived from elite and competitive sports with a strong focus on performance (Peeters & Megens, 2014; Vos et al., 2016). Generally speaking, they often suggest that ‘more is better’, while psychological and physiological aspects (referring to non-elite athletes) are only marginally taken into account and contextual ones not at all. The design challenge in recreational sports (or mass sports) differs fundamentally from those in elite sports. The group of recreational (or mass) sports participants is extremely heterogeneous, while elite athletes are rather homogenous in terms of physical abilities, training load responses, motivational drivers and attitudes. Both the acquisition, representation and visualization of data among recreational sports participants and less-active people holds scientific and design challenges. For instance, elite athletes are used to experimental lab settings and obtrusive measurements, as far as they generate a better understanding and/or enhance their performance. This kind of approach is not transferable to non-elite athletes and may even harm them as they are more vulnerable in terms of their own body perception, mental state and knowledge about exercise physiology. For instance, an overweight person may feel embarrassed and uncomfortable if asked to wear skin tight clothes with integrated sensors to measure body posture while other less-experienced sport participants get confused by (or confronted with) the numbers produced by their electronic device (e.g., heart rates, (an)aerobic zones, cadence, etcetera).

The design space in recreational sports (or mass sports) and physical activity is enormous. It requires a distinctive approach and envisioning of societal and personal needs. Among others, I foresee in my work three main research and/or design challenges, each of which in its own way is important for the long-term effectiveness of these designerly solutions.

### **The truth is out there**

One of the key concerns in the research and design with regard to leisure time sports and physical activity is the need to study actual, daily behavior in everyday life. Traditionally, lab settings are used to measure physical parameters of (sports) active people (see Figure 7).



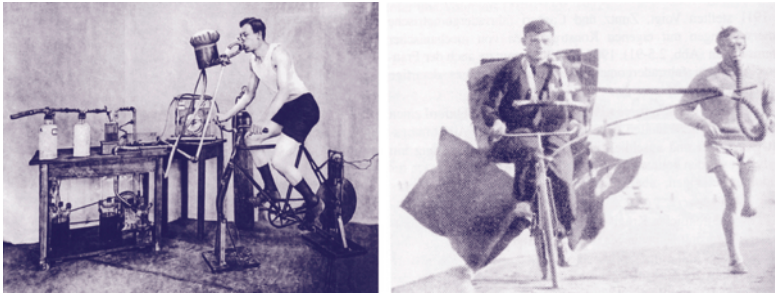


Figure 7

A classic lab setting for (running) research

The question is whether this lab behavior can be generalized to natural behavior in everyday life. This ecological validity of lab research is an important issue in the monitoring of physical activity. For instance, at Fontys (School of Sport Studies) my team, in close collaboration with 2M Engineering, has developed several (non-disruptive) approaches to validate the Active8 activity monitor in a two-step approach. First in lab settings, and next in a free-living environment (e.g., Arts et al., 2013; Goudsmit et al., 2014; Oomen et al., 2015; 2016).

Next, the generalizability of measurements is questionable. Whereas elite athletes have access to well defined lab facilities (and their number is very small), participants in recreational sports are ‘anywhere’, and it would be impossible to target them all with a lab-setting approach. Hence, if we want to be effective in our research and design for behavioral change towards physical active and vital lifestyles, we need to focus on people’s everyday life and their behavior outside the controllability of the research lab. This is obvious because people in general do not tend to live in research labs.

In recent years, the added value of real-world studies has gained growing recognition, although classical randomized controlled trials in highly controlled settings have been (and still are) dominant in research (e.g., Price et al., 2015). Controlled lab studies have a high level of internal validity, but their environmental, temporal and social fidelity is rather limited. In contrast, the level of external validity studies in everyday life is high as they take into account real-life factors and the heterogeneity of the population and the environment. Yet, it is obvious that research and design in real-life has to deal with challenges due to the lack of experimental control, susceptibility to bias and other contextual influences.

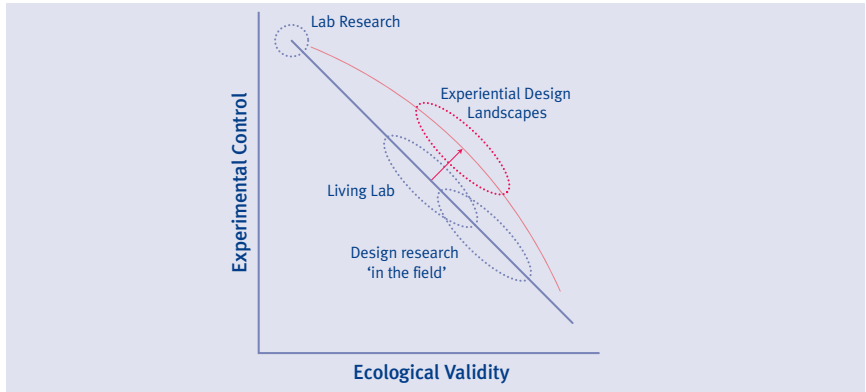


Figure 8

Experimental control versus ecological validity

Source: Peeters & Megens (2014)

True Living Labs (i.e., living labs in everyday life) and Experiential Design Landscapes (EDL) intend to raise the level of both experimental control and ecological validity to increase generalizability (Peeters & Megens, 2014; see Figure 8).

EDL is a design-driven research method developed by Peeters and Megens (2014) to design for and with real people in their natural environments aiming to effect a behavior change at local scale and to address global societal issues in the long run. With the EDL method, the design process is taken into society by creating infrastructures where designers work together with stakeholders in jointly creating experienceable propositions that can evolve over time. These experiential probes are intelligent, open, sensor-enhanced and networked product service systems that enable people to develop new and emerging behaviors, and in parallel enable detailed analysis of the emerging data patterns by researchers and designers as a source of inspiration for the development of future systems (Peeters and Megens, 2014). Bouncers and Social Stairs (Peeters & Megens, 2014) are two inspiring examples of this EDL approach.

### Acquisition, integration and application of meaningful data

A second concern is the importance of data-driven research and design approaches. The recent advances in wearable technologies have created new possibilities for research. For example, by combining running-app data with survey data (cf. a mixed data source approach) detailed insight can be gained in running behavior (see for example Vos et al., 2016). Another example is the research

approach Fontys and TU/e have applied in the Eindhoven Marathon 2014 (see Figure 9), where we used a combination of research methods to segment recreational runners via psychographic, demographic and physical variables (Vos et al., 2014). This integration of physical data generated via wearables, subjective perceptions collected via questionnaires and data extracted from visual information resulted in a more profound understanding of runner's actual behaviors. Indeed, the enrichment of biophysical sensor data (such as heart rate, energy expenditure, body posture, etcetera), with psychographic (survey) data (such as motives, attitudes and perceptions) and contextual data (such as socio-economic data, socio-geographical data, meteorological data, etcetera), allows for a better understanding of the individual, social and environmental factors that strengthen (or mitigate) participation in sports and/or physical activity. Yet, this kind of integrated data approach requires collaborative (multi-disciplinary) action.

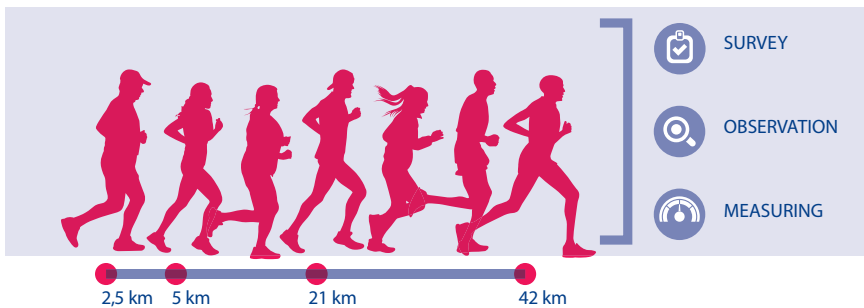


Figure 9

A combination of research methods during the Eindhoven Marathon

Source: Vos et al. (2014)

Today, we are living in a world controlled by sensors and big data networks (Huberts & Niemantsverdriet, 2013). Big data has become one of the hot topics in research and policy in the last two years. The biggest challenge is how to make sense of it. Without the collection of this data in a structural and systematic manner and without the expertise of data scientists this data remains meaningless.

Although an enormous amount of (relevant) personal and contextual data is acquired, the data analytics and the representation of this data in a meaningful manner to both end-users and (personal)coaches, based upon individual characteristics and requirements, are still largely lacking. There is a concerted effort required to (i) capture, process and store the data in a manner that allows meaningful combination with this and other data, (ii) transform the data into

meaningful information for the user, (iii) use this data to create fundamentally new value propositions that offer appealing low-threshold handles to take control of one's own body using the above information, (iv) create smart environments where people can use these propositions to successfully and sustainably adapt their lifestyle, and (v) scientifically verify and validate the effects achieved within ethically and legally acceptable boundaries. (These efforts were emphasized in the profile of this chair. Through data analytics and data visualization interesting patterns can be discovered, predictions can be made, fundamental understanding raised about behavioral patterns and the influence of individual, social and environmental factors, and systems and services designed to empower people to have an active lifestyle – see for example Van Renswouw et al., 2016).

### **Personalized approach – one size does not fit all**

There is a general acceptance that people are different. Nevertheless, most sports related applications, sport watches and wearables use a one-size-fits-all approach. Although this may be reasonable from a business point of view, it is not in terms of envisioning sustainable participation in sports and physical activity. The latter requires intelligent systems that are able to adjust to individual needs over time. Hence, this is a third key concern. Understanding the crossovers between personal (psychological, physiological, etc.), social (support from family, peers, etc.) and environmental factors (setting, context, culture, policy, etc.) is key for the design and provision of products and services targeting mass sports participation and physical activity. Although many user-driven research methods have been developed in the last decades such as participatory design (Schuler & Namioka, 2013), empathic design (Leonard & Rayport, 1997), co-creation (Sanders & Stappers, 2008), co-design (Sanders, 2005), probing (Mattelmäki, 2005) and experiential design landscapes (Peeters & Megens, 2014), these approaches often lack the multidisciplinary to target the mass sports, including perspectives from, for instance, social psychologists and human movement scientists.

As mentioned earlier in this lecture, the design challenge and the design space in recreational sports and physical activity is enormous due to the heterogeneity (in terms of psychological, physiological, sociological and environmental characteristics) of the people involved. Hence, generalizations are by no means self-evident. Two examples to illustrate this. While elite runners have a strong (and often sole) focus on performance, the drivers and motives of recreational and less-experienced runners are diverse. Indeed, there is ample evidence that recreational runners can be segmented in different groups based on psychographic characteristics (e.g., Ogles & Masters, 2003; Vos et al., 2016; Vos & Scheerder,

2009). Since 2013, Fontys and TU/e have been engaged in a joint research program entitled ‘Profiling and designing for sensibility and sustainability in running’ in which the Eindhoven Running Study (ERS) has been set up. This web-based survey has resulted, so far, in detailed information of over 25,000 recreational runners. Based on this detailed data, and applying the approach developed by Vos and Scheerder (2009), four distinct psychographic profiles of runners were constructed: (i) social competitive runners, (ii) individual fitness runners, (iii) individual competitive runners and (iv) social runners (Vos et al., 2016; see Figure 10). This typology is consistent with previous studies (e.g., Vos & Scheerder, 2009). The four groups of runners reveal considerable differences in drivers, context, intensity and perceptions of running, needs, usage of products and services, etcetera (Vos et al., 2016).



Figure 10

Four different psychographic profiles of recreational runners

Source: Vos et al. (2016)

The second example refers to the heterogeneity in physical abilities amongst recreational runners. We could calculate the ratio of the last finisher over the first finisher in a running event as a proxy of this variability. In the Eindhoven Marathon 2015 this ratio was 3.00 in the men’s 5k race (women’s race = 2.96), 2.32 in the men’s 10k race (women’s race = 2.13), and 2.68 in the men’s marathon (women’s marathon = 2.18). By comparison, in the recent Olympic Games in Rio 2016, this ratio was 1.05 in the men’s 5k race (women’s race = 1.12), 1.09 in the men’s 10k race (women’s race = 1.21), and 1.29 in the men’s marathon (women’s marathon = 1.39). If we compare these ratios, it is obvious that recreational and less experienced runners are extremely heterogeneous and require differentiated and personalized approaches, whereas elite athletes are rather homogeneous.

## Stage IV – Profiling, designing and validating for sustainable leisure time sports

*“Through generated data and models intelligent systems can enable individual coaching and tailored environmental interventions, taking into account physiological, psychological and contextual data.”*

People are different and live in different environments. Nevertheless, a healthy and active lifestyle is beneficial for all. Therefore, in my research I focus on different settings and target groups. For example, in a current PhD project, we are developing methods to measure and to improve the motivational climate in physical education lessons (Weeldenburg et al., 2016) while in a recently started PhD project we focus on employees who see their lack of sports and physical activity as a personal failure (Arts, 2016). And in yet other PhD projects, we focus on designerly solutions for the prevention of injuries in recreational running (Goudsmit, 2016; Janssen, 2015).

An important part of my current research work has to do with recreational running. This focus has several reasons. First, running has a mass appeal to new sports participants. It attracts a heterogeneity of people, both men and women, well trained people and people who are barely able to run, experienced runners as well as novice runners. Second, people can run anytime, anywhere and anyhow. Running fits our more dynamic and often less organized schedules and life patterns. Third, running implies a health-related focus and is considered as an important contributor to an active lifestyle. Fourth, running has a high turnover due to injuries and a lack of motivation and support. This raises the question whether designerly solutions could support this enormous group of unorganized and individual sports participants who lack facilities, personalized guidance and coaching support.

### **Inspirun – a personalized smartphone application for recreational runners**

Unorganized and less experienced runners often lack personalized support in how fast and how often they should run. Hence, in the Inspirun-project (Vos et al., 2016) we (Fontys – 2M Engineering Ltd – TU/e) designed a personalized running application that supports these runners and prevents them from dropping out due to injuries and lacking motivations.

Inspirun (see Figure 11) creates light and personalized running experiences for less experienced runners. It is a personalized running application for Android smartphones that aims to fill the gap between running on your own (static) schedule and having a personal trainer that accommodates the schedule to your needs and profile. Via a set of 12 dichotomous items, followed by a check question, the user is profiled. With the use of GPS and Bluetooth heart rate monitor support, a user's progress is tracked. The application automatically adjusts the training schedule after each training session, motivating the runner through personalized feedback, without a real life coach (Vos et al., 2016). The feedback is personalized and is provided and displayed in a manner that fits the profile. Indeed, most people are not good at thinking in numbers, and need to be motivated and coached in a different way (Swan, 2013).

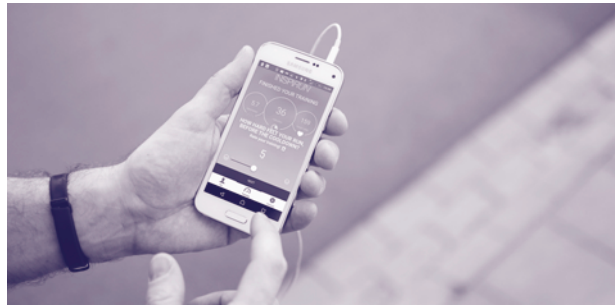


Figure 11

INSPIRUN: a personalized running coach for recreational runners  
Source: Vos et al. (2016)

A three-step approach was used (see Figure 12). This so called PDV approach for the design of intelligent systems for leisure time sports was developed in the PhD project of Mark Janssen (Janssen, 2015).

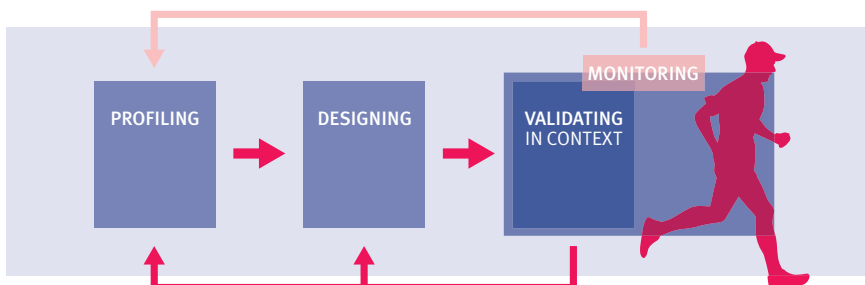


Figure 12

Profiling-designing-validating: Research framework PhD-project Mark Janssen  
Source: Janssen (2015)

First, profiles of runners were developed (i.e., profiling) based on data retrieved from the Eindhoven Running Study. This resulted in four distinct psychographic profiles (see Figure 10). Second, in several multidisciplinary iterations six essential features for the application development were distinguished: (i) start or improve running in a healthy and fun way, (ii) personalized training schedules that fit runners' profiles, (iii) scheduling has to take in to account runners' work-life balance, (iv) tailored feedback on progress while running (cf. runners' profiles), (v) a combination of perceived intensity and body feedback (heart rate), GPS data (distance, location, route, time) to adjust selected training scheme for the next training session, and (vi) capture data which can be used for policy monitoring (Vos et al., 2016). Next, the running application was tailored to the needs of runners (i.e., designing). We decided to use a smartphone as the platform for the running application. A distinctive quality of a smartphone is that it combines multiple purposes and technologies into a single device. Furthermore, a smartphone is easily accessible, a user can carry it and access data anywhere and anytime, it can provide feedback opportunities, global positioning system data can be used, etcetera (Fanning et al., 2012; Vos et al., 2016). Besides, the results of several quantitative and qualitative empirical studies we did at Fontys-TU/e showed that less experienced runners prefer a smartphone to a sports watch (e.g., Janssen et al., 2014; 2015). Third, the application was validated in context and qualitative feedback on the system was collected in user studies (i.e., validating). Initial results are promising. Participants were very satisfied with the personalized approach, both in the feedback and the adaptation of their training schemes (Vos et al., 2016).

### **Run! – a high-tech running path in the park**

Another example of the joint efforts of TU/e and Fontys in the design of smart solutions for recreational runners is the Run! project (Megens et al., 2016). In this project an attempt has been made to provide a structural facility and support for unorganized recreational runners in an urban area. A public environment can become a running infrastructure by adding sports related applications. Run! (see Figure 13) is a high-tech running path in Genneper Parken (in the city of Eindhoven). The Run! EDL consists of 25 poles with LEDs on top, which run alongside runners and speed up over time. This way Run! tries to stimulate people to change their current pace just a little over a brief distance. This can make runners train more intensively for a brief period, but also stimulate people who walk by to run a little faster (Megens et al., 2015). In this EDL, we were able to explore opportunities with runners and people passing by. Moreover, the





Figure 13

RUN! – an interactive running path in the park

Source: Megens et al. (2016)

system was developed in such a way that a continuous insight into the usage data was generated.

### **Analyzing and visualizing running-app user-generated data for urban planning**

A third example of the joint efforts of Fontys and TU/e in the design of smart solutions for recreational runners is a study, based on running-app data provided by Energy Lab, in which we are exploring the value of user-generated (big) running data for urban planning of active and healthy public spaces (van Renswouw et al., 2016). One of the advantages of running related smartphone applications is their ability to track behaviors over time in the daily urban environment (Vos et al., 2016). There is ample evidence that individual, social and environmental factors influence physical activity levels and behaviors (e.g., Granner et al., 2007; Larson et al., 2014; Sallis et al., 2016b). Where, how and why people run is notably influenced by urban layouts. Hence, in our study we aimed to create an insight in the extents of this influence, using GPS trail data collected via two popular running apps, in combination with a qualitative survey of running hot spots (van Renswouw et al., 2016).

Three iterations were set out to gain understanding of the characteristics of (good) running environments. The first iteration used data visualization techniques to get geographic insight into the running-app data, and to identify running hotspots and other points of interest for further analysis. The second iteration used a mixed data source approach to combine running data with twenty qualitatively scored environmental characteristics of the selected running hotspots to identify the

possible influencers of the attraction of these areas for runners. In the third iteration we have scaled this up to over 270 running spots in Belgium and the Netherlands to generate further insight into the influencers of good running environments, such as surfaces, distance of paths, green areas, light setting, etcetera (van Renwouw et al., 2016). Among others, green and natural environments, good light settings and the maximum uninterrupted length on a track or path were found to be interesting potential environmental influencers (van Renwouw et al., 2016).

The use of socio-geographical, human movement and other data has an added value for policy makers to monitor, evaluate and improve their sport and physical activity policy interventions (Vos et al., 2016). For instance, a consortium of TU/e, Utrecht University and Fontys collaborate on this with the city of Eindhoven.

## Stage V – What's next?

*“Technologies and strong partnerships offer us many advantages to stimulate healthy and active lifestyles.”*

I mentioned already in the beginning of this lecture that I'm not a clairvoyant. Nevertheless, in this fifth and last stage of my lecture I will conclude with some short remarks about the future.

More than ever, the time is now to combine effort and expertise to stimulate healthy and physical active lifestyles. The establishment of the Dutch Topteam Sports in 2014 has accelerated the need for focus and joint efforts in sports and exercise research and innovation. This was followed by the development of a *'National sports innovation agenda'* and calls for ideas and innovation centers. In spring 2016, the *'National knowledge agenda sport and exercise: From the steps to the podium'* (Backx et al., 2016) was published. This knowledge agenda was jointly written by nine people from different universities and universities of applied sciences in the Netherlands. Being one of the authors of this agenda, I'm convinced that it will succeed in its ambition to be the starting point for the development of enduring partnerships in research and innovation regarding sport and exercise. Besides a strong content, this agenda emphasizes a broad multidisciplinary approach based on sustainable partnerships between knowledge institutes, the sports sector, industry and local and national governments.

The energy in the process of writing this knowledge agenda, and the positive inputs during consultation rounds with representatives from all stakeholders involved, was used to create a *'National science agenda route for sport and exercise'*. In addition, an *Icon project 'VIDAS'* was submitted emphasizing the need for joined efforts to utilize the vital role of big data and data science. I'm most happy to contribute to this, and I'm convinced that the expertise of TU/e has added value for the national ecosystem.

Physical (in)activity pervades our society. The design challenges in leisure time sports and physical activity are enormous. It is certainly one hell of a job. But it is an application area which gives satisfaction and, when we succeed, we can

generate societal impact. Moreover, even elite sports may benefit from the research and design approaches we develop for a non-elite sports market. I'm convinced that finding solutions to tackle physical inactivity and drop-out from sports requires the envisioning of a changed society and cross-disciplinary and cross-sector approaches with multiple stakeholder involvement. A broad multidisciplinary and applied approach is essential to deal with the complexity of societal transformations (see Figure 14). This is by no means self-evident. In that sense I'm proud of the intense partnerships between the department of Industrial Design and Fontys University of Applied Sciences, School of Sport Studies, which started in 2013. Not by talking and making big plans, but by starting together with little planning and few ground rules. In our local ecosystems we work in close collaboration with other departments and institutes of TU/e, Fontys and other knowledge institutes. A considerable number of industrial and public partners also cooperates. The strength of these partnerships is that we share the ambition to stimulate participation in sports and physical activity through smart and designerly solutions. This collaboration in research and innovation projects has also resulted in inspiring educational initiatives in which students from different backgrounds (in disciplines and educational systems) work together in authentic learning situations. They share the same context and ambition, but have different expertise and learning objectives.

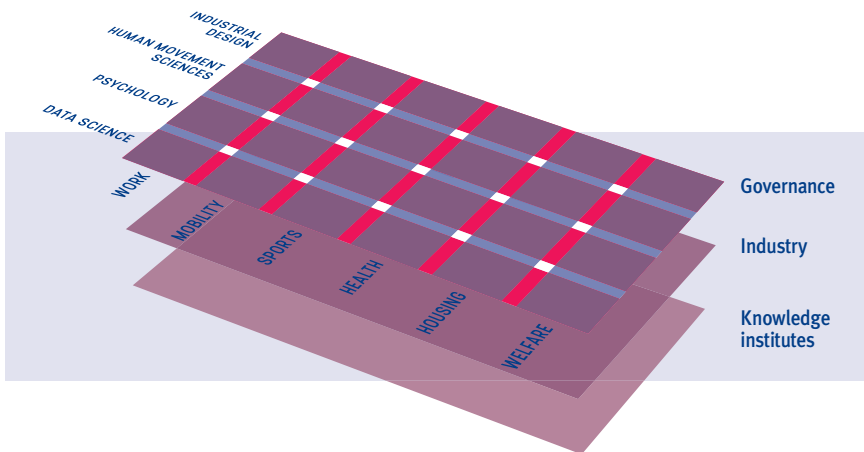


Figure 14

A need for cross-disciplinary and cross-sector approaches

Research on leisure time sports and vitality at a university of technology may not be evident at a first glance, but I hope I have shown in this inaugural lecture the potential contribution of industrial design for an active and vital society. The department of Industrial Design at TU/e envisions a world where fundamental human values are addressed, and state-of-the-art technology is employed to design interactive and (co-)evolving systems to empower people towards a state of complete physical, mental, emotional and social well-being. I hope my research and educational work will contribute to this ambition, and let's hope we all will live active and vital ever after.

## Epilogue – Acknowledgements

In het wielrennen is het de ‘kopman’ van een wielerteam die de bloemen op het podium in ontvangst neemt. Zijn teammaten, begeleiders, verzorgers en mecaniciens die de sleutel tot dit succes vormen, blijven meestal buiten beeld. Hier is het niet anders. Ik ben vereerd om vandaag hier op dit podium te staan en mijn ‘scientific bike race’ met jullie te delen, maar ook hier is dit het resultaat van een team-effort. Ik wil dan ook graag de gelegenheid benutten om een aantal personen in de spreekwoordelijke bloemetjes te zetten. Ik besef dat ik door de beperkte lengte die ik heb voor dit dankwoord veel mensen te kort doe, dus bij voorbaat al mijn excuses hiervoor.

Eerst en vooral mijn ‘teammanagers’ Matty en Aarnout. Zonder jullie stond ik hier niet. Naast een voorliefde voor hardlopen, delen jullie een groot enthousiasme om door samenwerken het verschil te maken. Dankzij jullie krachtenbundeling werd mijn leerstoel gerealiseerd. Matty, in 2013 benoemde je me als lector bij Fontys Sporthogeschool. Jouw vertrouwen en daadkracht zijn tomeloos groot. We hebben meestal aan een half woord genoeg om elkaar te begrijpen. Je biedt me alle ruimte en vrijheden en je maakt me, wanneer nodig, bewust van het belang van een goede balans tussen gezin en werk. Aarnout, vanaf onze eerste kennismaking in 2013 zijn we snel gaan samenwerken rondom de Marathon Eindhoven. Je bent de drijvende kracht achter de realisatie van mijn leerstoel. Ik bewonder je energie om naast je bestuurlijke verantwoordelijkheden, internationaal, landelijk, maar vooral ook binnen de TU/e, het belang van innovatie en onderzoek naar sport en vitaliteit uit te dragen en hiervoor het pad te effenen. Mijn dank gaat zeker ook uit naar de Colleges van Bestuur van respectievelijk TU/e en Fontys Hogescholen, het faculteitsbestuur van Industrial Design en het managementteam van Fontys Sporthogeschool die mijn aanstelling als deeltijd hoogleraar mogelijk maken.

Ik heb het geluk te kunnen rekenen op een grote groep van enthousiaste ‘teamleden’ die me iedere dag opnieuw weer inspireren om een tandje bij te steken. Ik ben trots op mijn team van docent-onderzoekers binnen het lectoraat Move to Be en hun drive om samen met studenten en professionals slimme oplossingen te ontwikkelen voor duurzaam sporten en bewegen. De collega’s en studenten van de faculteit Industrial Design prikkelen me met hun creativiteit en

open houding om mijn grenzen steeds weer te verleggen. Ik kijk er naar uit om samen verder de design challenges op vlak van sport en vitaliteit aan te pakken.

Mijn leerstoel is nadrukkelijk gericht op het bouwen van bruggen tussen diverse disciplines. Van industrial design tot psychologie, van bouwkunde tot data science, van bewegingswetenschappen tot engineering. Dankzij mijn leerstoel, en in combinatie met mijn lectoraat bij Fontys Sporthogeschool, heb ik het genoegen om samen te werken met collega's uit andere faculteiten binnen de TU/e en kennisinstellingen uit alle mogelijke windstreken van Nederland. Ik wil zeker ook alle betrokkenen danken voor de open houding en de prettige samenwerking bij de ontwikkeling van de Kennisagenda Sport en het Lectorenplatform Sport en Bewegen. Hiermee onderlijnen we het belang van duurzame partnerships. Dank aan alle betrokkenen vanuit het Topteam Sport, beleidsverantwoordelijken en subsidieverstrekkingen om dit mogelijk te maken.

Het was dan ook niet toevallig dat ik 'crossing borders' koos als titel voor het minisymposium dat mijn rede voorafging. Hans, Jeroen, Joost, Koen, Maarten en Stef, een welgemeende dank voor jullie voortreffelijke bijdrage tijdens het symposium en de snelheid waarmee jullie onmiddellijk toezegden om dit te willen doen. Ik ben trots op de nauwe partnerships binnen en buiten de dynamische regio Eindhoven waarbij we technologie en innovatie maximaal willen benutten voor breedtesport en vitaliteit. Dank aan alle betrokken kennisinstellingen, fieldlabs, lokale overheden en bedrijven voor het geboden vertrouwen.

Ik ben de 'trainers en coaches' die me 'vormden' zeer erkentelijk. Opgeleid als sociaal psycholoog heb ik mij als onderzoeker met een sterke beleidsgevoeligheid kunnen ontwikkelen binnen het Onderzoeksinstituut voor Arbeid en Samenleving (KU Leuven) en later het Toegankelijkheidsbureau en het Vlaams Expertisecentrum Toegankelijkheid. Dankzij deze instituten is multidisciplinair werken en het bundelen van krachten een evidentie geworden. Mijn passie voor beleidsgericht onderzoek naar sport en bewegen werd in Leuven door Jeroen en zijn medewerkers gevoed in mijn werkzaamheden binnen de Onderzoeksgroep Sport- & Bewegingsbeleid van de Faculteit Bewegings- en Revalidatiewetenschappen (KU Leuven). Het is een voorrecht om vandaag nog steeds deel uit te mogen maken van deze uiterst gedreven groep van onderzoekers. Dit sportverhaal kreeg een mooi vervolg binnen Fontys Sporthogeschool. Een fantastisch mooi instituut waar 'durven doen' centraal staat.

Voor de vormgeving van de beelden in mijn intreerede kon ik rekenen op de creatieve skills van Carl Megens. Janneke, Valerie en Maartje en hun team zorgden voor de voortreffelijke productie van dit werk in boekformaat en de organisatie van deze rede. Daniëlle, Liesbeth en Hanneke zorgden er voor dat de uitnodigingen op de juiste plek terecht kwamen. Een oprechte dank aan jullie allen.

De koninginnenetappe in dit dankwoord gaat uit naar zij die zeer dicht bij mij staan. Ik denk hierbij aan mijn vrienden en familie die nu eens de rol van ‘supporter’ op zich namen, dan weer die van aangename plezierverschaffer. Het leven is een samenspel van nature en nurture. Mijn ouders hebben mij alle kansen geboden en lieten me opgroeien in een warm nest. Ik pluk hiervan nog iedere dag de vruchten.

Last but not least, en boven alles en iedereen, mijn gezin. Sem, Gus en Ellen, jullie zijn mijn rustbakens en zien me vooral onvoorwaardelijk graag. Ellen, dank voor hoe je mij, Sem en Gus elke dag weer uit de wind zet. We zijn ons eigen kleine wielerteam en jullie zijn mijn echte sterren.

Ik heb gezegd.



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# Curriculum Vitae

**Prof. dr. Steven Vos was appointed part-time professor of Design and Analysis of Intelligent Systems for Vitality and Leisure Time Sports at the Department of Industrial Design at Eindhoven University of Technology (TU/e) on October 1, 2015.**

Steven Vos received a Master of Science degree in Psychology and a PhD degree in Human Kinesiology from KU Leuven. In 2013 he was appointed Associate Professor (Chair Move to Be) at the School of Sport Studies, Fontys University of Applied Sciences. In addition, he is a research fellow at the Policy in Sports and Physical Activity Research Group at KU Leuven. Before that, he worked as a senior research associate at the Research Institute for Work and Society (KU Leuven) and the Policy Research Centre for Culture, Youth & Sport. He was also research and development manager at the Office for Accessibility, and later on The Flemish Expert Centre for Accessibility, a spin-off. With his multidisciplinary research he wants to contribute to the design of smart solutions for vital and (sports) active people, taking into account individual, social and environmental factors.

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