



# Tuning your body

Tackling stress and sleep problems in a more natural way

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## Abstract

The experience economy offers us a multi-faceted lifestyle, allowing us to engage in richer, intense experiences, access more knowledge and information than ever before, and often juggle many different roles even in the course of a single day. This inevitably has a number of downsides, one of which is that we often subject ourselves to unnatural levels of stress, which in turn have a serious effect on our ability to sleep.

To stay healthy we need to reduce stress, sleep well, create a more natural routine and find time to reflect and re-energize. However, this is not news. Almost everyone seems to know what is and isn't good for them. The challenge for companies is to empower – as well as stimulate, educate and motivate – people to adopt healthier lifestyles in a way that doesn't require too much disruption or upheaval.

The key proposal in this paper is based on enabling people to move towards a 'natural tuning' of their bodies. Most of the solutions available today are too far removed from every day life. We believe it is essential to link into the

biological rhythms of the human body, in the context of everyday life. People need to be able to build solutions to their own demands and situations, which in time will enable them to adjust their daily routines to incorporate new rituals of self-care and sustainable wellbeing.

This paper explores various options in achieving this. It focuses on areas in which Philips, with its enabling health solutions, can support people in overcoming obstacles to changes in lifestyle. Throughout the paper we show ideas and solutions, many designed by Philips, which can be used as creative triggers in determining whether we can truly change lifestyle through the objects, systems and services that surround us.

The first chapter, examines social, cultural and physical factors relating to stress and sleep. In the second chapter, the biological aspects are discussed in greater detail. Chapter 3, looks at some of the solutions currently available, and chapter 4 various considerations are proposed that have to be addressed in order to move towards sustainable proposals based around natural tuning.

# Introduction

According to the Nutrition & Health Open Innovation Lab [1], 25% of all health problems could be prevented through maintaining a healthy diet, exercising enough, reducing stress, sleeping well and having safe sex. This begs the obvious question; if staying healthy is this simple, why don't people comply, especially if doing so could increase their quality of life?

## **Why are sleep and stress important?**

Take sleep as an example. A good night's rest is indispensable if we are to function well during the day. It helps us remain alert, remember things more clearly, feel energized and even look better! Sleep deprivation on a regular basis leads to memory and concentration problems, makes us less resistant to illnesses and liable to suffer from decreased mental and physical health. Without enough sleep we also become less sensitive to serotonin, a neurotransmitter closely related to mood, emotions, sexual activity, appetite, feelings of satisfaction and happiness [20]. Yet many of us don't sleep as well as we could.

It is a modern dilemma; to stay healthy we should reduce stress and sleep properly, but our hectic lifestyles don't always give us the opportunity to do so. The way we live and work often produces considerable stress. What's more, the amount of stress in people's lives is rising all over the world, which also has a negative influence on their wellbeing, performance and health. Not only do we find insufficient time to sleep and relax, we are also confronted with both short- and long-term health issues.

We also think that any necessary improvements would require a drastic change in the way we live. That is why there is a growing need for solutions that help us improve both the quality of our lives and our health, but which are easy to experience and cause minimum disruption.

# 1 Changes in society

## 1.1 Socio-cultural influences on stress and sleep

Lack of sleep and excessive stress affect our entire society and represent a health risk that has a considerable social and economic impact. The opposite also applies; less stress and sufficient sleep means lower incidences of illness and better health. Healthy children learn better, healthy adults are more productive; both stimulate the development of our economies and societies. The role sleep plays in our lives – and the way we deal with relaxation – is strongly influenced by our social and economic context, as well as our cultural values and beliefs. In recent years major changes in our environment and the way we live have contributed to the emergence of sleep and stress issues.

### Speed and the convenience society

In the last hundred years, many aspects of our lives have changed. Practically all human activities now take place at an increased speed; acceleration seems to be the chief characteristic of modern times. The introduction of the light bulb, for instance, has made it possible for people to stay up late, go to sleep much later and sleep in a more concentrated burst throughout the night. It's estimated that in the second half of the 20th century, people in the developed world have decreased their average amount of sleep by about 10%. [2] [301]

The invention of many consumer goods has also offered people the possibility to save time by reducing domestic chores. Simple, 'thoughtless' household chores have been replaced with 'meaningful' activities that cause us to use our brains and engage our sense more intensely. But the lack of simple tasks has led, in effect, to less time spent unwinding. This has been exacerbated by the advent of television and then computers, which constantly bombard us with 'input' and leave less time to reflect.

Figure 1: Excessive stress in our society impacts our health



### Mosaic living

In Western societies, people used to have one predominant role in a structured life that was characterized by daily routines. Nowadays, people fulfill multiple roles, each of which has its own environment and community. [2] Being a parent, professional, colleague, friend, neighbour, commuter and member of various organizations, all at the same time, makes life hectic and complex. One day is different from the next, and regular sleeping patterns and moments for relaxation are no longer so easy to find. [18]

People also dedicate less time to their health, which affects their daily routines. They have higher expectations of personal development and experience greater pressure living their multiple roles. We're confused about how to set priorities and how to take care of ourselves in the situations that cause stress.



### Knowledge society

The Industrial Age has been transformed into the Knowledge Age, computers have replaced handlooms and the office has become our indoor workshop. People in Western societies have moved from the physical labor of producing agricultural and industrial goods to the mental labor required to organize and trade goods produced elsewhere. [2]

Physical labor required natural breaks for physically relax and 'reload'; sleeping well gives our bodies and minds a chance to rebuild and re-energize. Desk jobs do not. Instead people try to mentally unwind, even though this does not always leave enough space for the relaxation and sleep that the body requires.

For good sleep and less stress, a life with a proper routine is vital. But if this cannot be accommodated into our irregular lifestyles, what do we do? Would it instead be possible to 'fine tune' our lives using a more flexible approach, so our bodies could benefit from the advantages associated with better sleep and relaxation?

### **Cultural differences in sleep behavior**

Cultural differences account for differences in sleeping rhythms. In a number of warm countries, it's very common to have a siesta after lunch. Even bedtime differs per culture. In a study covering a large number of countries, it was found that three-quarters of the Portuguese go to bed after midnight, while 72% of Indonesians get out of bed by 6:00. [33]

## **1.2 Lifestyle changes and risks**

In recent decades, there has been a rise in new types of ailments: so-called 'lifestyle diseases' that grow out of our long-term choices and habits. There are four major contributory factors; unhealthy diet, lack of exercise, too much stress and insufficient sleep. This section focuses on the negative influence of these risk factors, especially in relation to sleep and stress.\*

### **Less room for routine**

Due to artificial light and the 24-hour economy, people can spend the night working or entertaining themselves. The Internet has created virtual communities accessible all the time and, for some people, day and night have merged. How can they find time for proper rest, reflection and relaxation? For students, gamers, shift workers and a host of others, sleep is no longer exclusively a night-time activity. It's also often considered as a kind of afterthought; many people are getting used to making up lost sleep in the weekend.

We have reduced the time for sleeping and relaxation but have not replaced this with a satisfactory alternative. As a result, we are demanding more from our bodies and our minds. It would be good to tune our sleep and relaxation in a way that fits best with our biological needs. Traditional routines need to make room for more flexible alternatives.

### **The influence of exercise and nutrition**

Many people don't get enough physical exercise to stimulate all body functions, and don't take proper breaks to let body and mind recalibrate again. They are emotionally tired but not physically tired at bedtime.

In addition, over the last decades our eating patterns have changed. The variety of food – both nutritious and unhealthy – has increased. Portions have grown bigger, even though our increasingly passive bodies need less food, and there are more unhealthy foods that have a negative influence on our overall feeling of wellbeing. Studies show that many convenience foods induce fatigue, mood changes, concentration problems and headaches. Recent studies have shown that people who suffer from lack of sleep over long period often gain weight. [5]

\*for more information on this subject, see the Living in Balance [3] and Living Independently [4] positioning papers.

### Misconceptions in dealing with stress and sleep disturbances

People are often not aware of their own patterns and behaviors. They often don't recognize negative stress, nor do they interpret the consequences as signals of stress. Such misconceptions can cause them to not take action in time or set unrealistic goals for themselves. [6]

Sleep misconception – or pseudo-insomnia – is based on a faulty understanding of ones' own behavior. Patients with this disorder actually sleep well, even though they think that they do not. Although it's a matter of subjectivity, this disorder can even cause sleepiness during the day. Sleep centers can give insight into sleeping behavior. When the sleep disorder is analyzed and recognized this can empower people to change their sleeping patterns.



Figure 2: Sleep disturbances often experienced by seniors

“The biggest factor for a good night's sleep is your state of mind when you go to bed.”

Jim Horne, Director of the Sleep Research Centre, UK [36]

### Transitions

During lifetime people go through transitions, often triggered by biological or social changes. These affect their daily lives and prompt them to adjust to new habits and routines. But this requires insight in their behavior, an understanding of the new situation and the ability to tune their behavior and adjust to it accordingly.\*

This, of course, also applies to sleep and stress problems, especially of seniors. Retired people miss the daily work rhythm and are prone to fragmented sleep. They develop a tendency to nap during the day and often develop irregular sleep patterns at night. They also suffer from sleep misconception and are highly sensitive to environmental disturbances, partly due to a higher intake of medication and partly because of their physical and mental problems. It's estimated that 50% of those over 50 and 80% of those over 65 suffer from chronic sleep disorders. [7] [8]

### Medication

When people are confronted with sleep and stress problems, they sometimes choose, according to their doctor's advice or not, to use medication. But by doing so, they force an unnatural routine upon themselves and can develop a two-fold dependency. One is biological, as medication such as Benzodiazepine calms and sedates them by reducing the tension that prevents them from falling asleep. Their bodies end up needing the medication to relax. The second is psychological, as they end up believing that they cannot sleep well, or at all, without medication.

A more empowering and natural solution would be to keep away from medication and rely, instead, upon a combination of education and modified behavior before, during and after sleep. At the same time people should challenge unrealistic expectations on misconceptions to reduce stress and bring piece of mind. As our world changes, it is important to acknowledge that different people will need more flexible solutions, which they can calibrate for maximum effect when they're needed.

\* For more information on this subject, see the Living Independently positioning paper: [4]

# 2 Facts about stress and sleep

The previous chapter addressed how strongly the influence of our lifestyles and surroundings are impacting us. To truly understand sleep and stress, it's important to understand the biological facts as well. This chapter provides a short summary and looks at the way our environment influence both.

## 2.1 What is stress?

Stress is a mentally or emotionally disruptive or upsetting condition occurring in response to adverse external influences and capable of affecting physical health, usually characterized by increased heart rate, a rise in blood pressure, muscular tension, irritability, and depression. [9]

Originally, in primitive times, stress was an instinctive physical reaction to situations in which we needed to fight or run for safety. Today, it can just as easily be caused by issues like traffic congestion, financial problems, relationships, workload and disempowerment. Stress raises adrenaline to enable us to deal with our problems, but when this stays in our bodies it can cause anxiety. [10] [11] [12]

Stress is on the increase, and with it comes a negative impact on our feeling of wellbeing. When its symptoms are not dealt with in time, they affect us in everything we do, from our relationships and work to our health and happiness. It makes it difficult to fall asleep, or when aroused as part of the natural sleep process, to fall back to sleep. It is also thought to be one of the main influencers of certain lifestyle diseases. [19]

Many people are not able to tackle stress on their own. People find it hard to seek help in dealing with stress, and tend to think that they can sort it out themselves. They often wait too long after the first symptoms appear, progressing to a stage where it is more difficult to treat.

## Acute stress and chronic stress

In general, there are two types of stress, depending on whether or not people take action accurately and immediately. [13]

- Acute stress is an immediate response to a particular situation.
- Chronic stress builds up gradually over time when the factors causing acute stress are not dealt with quickly and accurately.

Research also shows that there are two kinds of people who suffer from stress: those who suffer consciously and those who remain unaware that what they are feeling is stress. These are the people who need to learn to recognize it so that they can take appropriate measures to deal with it. If the stress, or the behavior that causes it, continues to be neglected, it can reach far more serious levels. [15]

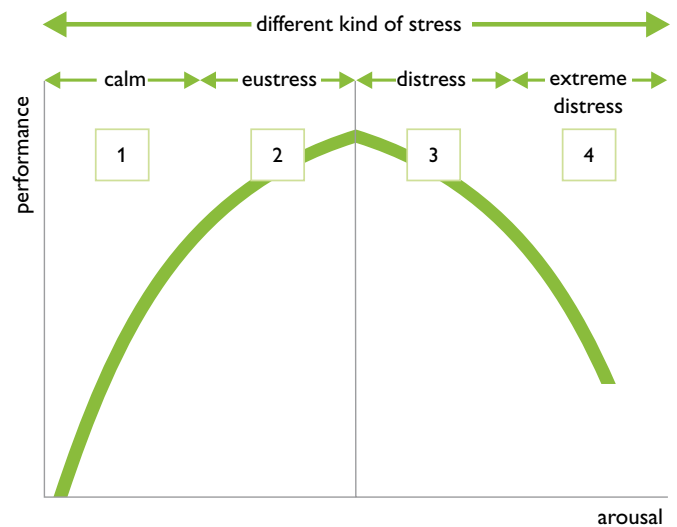


Figure 3: Stress levels flow [15]

### Stress levels and stressors

A stressor is an event or context that elevates adrenaline and triggers the stress response because it throws the body out of balance and forces it to respond. There are environmental stressors (elevated sound levels, over-illumination, overcrowding) daily ones (e.g. traffic, lost keys) life changes (e.g. divorce, bereavement) and those in the workplace (e.g. role strain, lack of control). [13] [14]

However, some kinds of stress – and stressors – actually have a positive influence on our performance and feeling of wellbeing. According to Robert Yerkes, John Dodson and Hans Seyle, there are 4 different levels of stress [15];

#### 1. Calm

People experience insufficient stressors in their lives and, as a result, feel tired, unhappy and do not perform well.

#### 2. Eustress

This has a positive effect on people, making them feel happy and energizing them so that they perform better.

#### 3. Distress

People begin to feel unwell, unhappy and experience symptoms such as headaches, concentration problems and fatigue.

#### 4. Extreme distress

Sufferers begin to experience 'burnt-out', with severe consequences for their overall feelings and performance.

Stress needs to be dealt with at the correct level. This is vital if people are to interpret the symptoms and tackle them properly. And it should be noted that while it is preferable not to reach level 3 at all, the influence of our lifestyles and cultures means this is not always possible.

The best moment to tackle excess stress is at the 'moment' between levels 3 and 4. Once someone has entered level 4, it will take a very long time to recover and will entail a major lifestyle. Stress should always be dealt with when relatively unobtrusive changes can still offer a solution.

The success of solutions that facilitate awareness and self-help depends on the nature of the stressors causing the problems. The death of a relative, for instance, will be harder to deal with than a temporary extra task at work. [16]

### 2.2 What is sleep?

Sleep, as everyone is undoubtedly aware, is absolutely essential to our well-being. During sleep, most physiological functions such as body temperature, blood pressure and heartbeat rate slow down. However, sleep is an active process of physical and mental regeneration. It's a time of repair and growth; some tissues proliferate more rapidly during sleep. One of the mental processes occurring during sleep is the storing of daily experiences and impressions in the long-term memory. [18]

In 1952, the electric activity of the brain during sleep was detected. Scientists discovered that sleep consists of four or five stages, each distinguished by different patterns of brain waves. Four of these stages are characterized by different depth. The fourth, the deepest, is the one from which it is hardest to be awakened. The fifth stage is characterized by 'Rapid Eye Movement' (REM) sleep. During REM sleep, one's eyes move rapidly while the rest of the body appears to be almost paralyzed, and it's very often during this period that people dream. The brain remains intensely active, although in a different manner than when awake. [17] [18] [19]

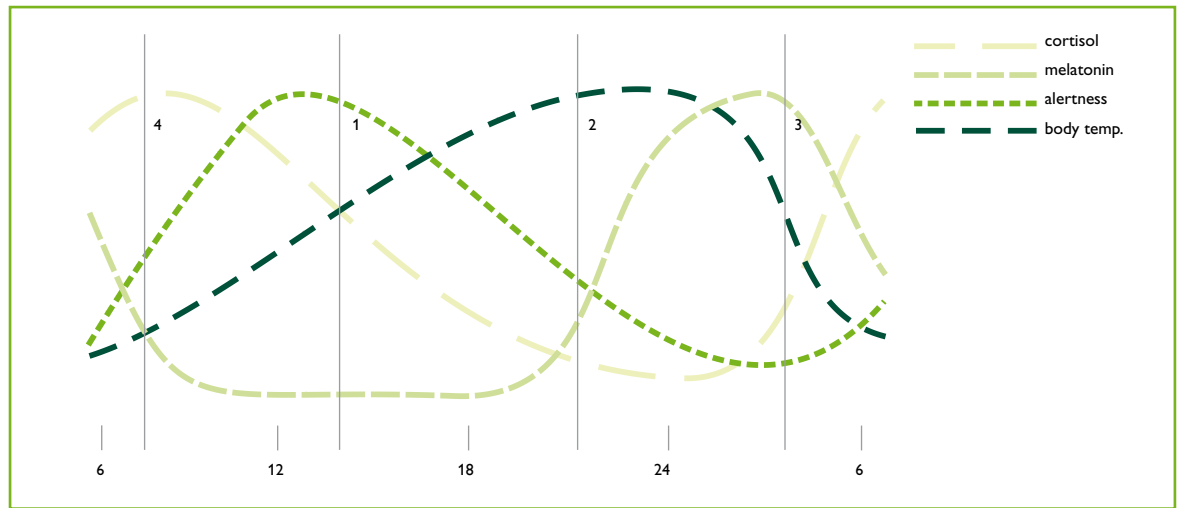


Figure 4: Flow of biological changes in a 24-hour cycle with respect to the circadian rhythm

### Circadian rhythms – the biological clock

People have a biological clock of 24 hours. This is known as the 'circadian rhythm'. [18] [20] Within this 24-hour cycle, a great number of physical and mental processes are regulated. For instance, as the evening approaches, the level of the sleep hormone melatonin increases, while the level of the stress hormone cortisol decreases. When it's time to wake up, this process reverses. In addition, the body temperature rises by 1°C from its lowest level at around 06:00 to its highest at around 19:00.

Our circadian rhythm causes us to feel sleepy at night, and alert in the morning. It also makes us feel drowsy in the early afternoon, a phenomenon often referred to as the 'post-lunch dip'.

### Sleep stages in the circadian rhythm

The circadian rhythm has four main stages.

1. Napping or the 'post-lunch dip': This is the moment early in the afternoon when we feel slightly drowsy and ready to take a nap. A short nap can be very refreshing, even more than would normally be expected from its short duration. However it can also interfere with the circadian rhythm, making us sleepy for the rest of the day or affecting our night-time rest. The challenge is to nap just enough to be refreshed, but not enough to interfere with a good night's sleep.
2. Falling asleep: Falling asleep is a gradual process. When the time comes to go to bed, our biological clock dictates that body temperature lowers and melatonin and cortisol levels alter, so that we can relax both physically and mentally. Sleep rituals – for example, reading – help as they constitute a transition period from high mental and physical level of activity to reduced levels of both.
3. Sleep: Sleep is the state in which we become relatively quiescent and unaware of our environment. It is also an active process of physical and mental regeneration, during which most physiological functions such as body temperature, blood pressure, rate of breathing and heart rate slow down.
4. Waking up: Sleep becomes lighter as we move from stage 4 to stage 3. We also wake up more often, although often without remembering these brief arousals. Body temperature rises, melatonin levels decrease and cortisol levels increase. Waking up is a more pleasant experience depending on the sleep stage we have reached. [18]

### Disturbances to the circadian rhythm

Not being able to fall asleep or having broken sleep often causes a higher level of stress hormone and brain activity. People concerned too much about sleep can suffer from stress and tension which in turn, can affect their ability to sleep. Without enough sleep we become less sensitive to serotonin, a neurotransmitter closely related to mood, emotions, sexual activity, appetite, feelings of satisfaction and happiness. This makes us less resistant to illnesses and more liable to a general decrease in both physical and mental health.

### Jet lag and other disruptions

The biological clock can also be disturbed by lifestyle transitions and changes to our daily routines and rhythms. For example, jet lag can disrupt our sleeping patterns completely and make us feel warm or cold at unexpected moments. It has been shown that our biological clock has cycles of 25 hours; natural light adjusts this inner clock to the 24-hour cycle. When flying westward, with the sun, jet lag is less severe since the day and night cycle is longer and more in accordance with our inner biological clock. Because our body adjusts to light, people suffering from jet lag are advised to expose themselves as much as possible to the natural daylight.

Another disturbance of people's biorhythm is the lack of light during the winter season. Seasonal Affective Disorder, such as winter depression, makes people sleep too much and create problems with waking up. The time available to wake up is often determined by people's daily schedule and not linked to the needs of the body. [26]

### Transitions

During a lifetime, biological and socio-cultural factors lead to changes in sleeping patterns. After birth, our sleep patterns are extremely fragmented and settle down gradually. Beyond the age of 60, the amounts of REM sleep, as well as deep sleep, decreases and the tendency to nap increases. As people grow older they usually function best in the morning.

When growing older, women go through hormonal changes which also affect their sleep. Research suggests that sleep duration can be related to Follicle-Stimulating Hormone (FSH) levels produced during their menstrual periods. FSH levels were 20% higher in long-time sleepers than in short-time sleepers. In general, due to monthly hormonal changes, women have less stable sleep patterns, an occurrence repeated during the menopause. [21]

### The relation between stress and sleep

While acute stress as a response to immediate danger is helpful, chronic stress is not; it diminishes the quality of sleep and often prevents a good night's rest. In the Netherlands alone, absenteeism and an inability to work due to chronic stress, in combination with the medical care required to treat it, are estimated to cost €4.7 million a year.

One can probably live longer without food than without sleep: rats with sleep deprivation died after 14 days. [22]

### 2.3 The influence of our environment

Our immediate environment can negatively affect the quality of our sleep, a phenomenon also known as Extrinsic Dyssomnia. This is not only due to physical factors like noise, light, temperature or a partner with a different sleeping and waking rhythm, but also to psycho-social factors such as sleeping in an unfamiliar place, or needing to be alert to take care of sick loved ones, situations in which it is impossible to relax properly. [18] [19]

#### Light and color

The color and intensity of light influence both the quality of our sleep and our feelings of stress. During the day, as the color of natural sunlight changes, our body responds accordingly: bluish morning light has an activating (alerting) effect as the level of cortisone increases, while the red sky in the early evening has a relaxing effect as the level of melatonin increases. We sleep best in a dark or dim room. [24]

#### Temperature

Temperature is an ambiguous external factor. As we fall asleep, our bodies cool off, especially the head. Taking a hot bath about half an hour before going to bed engenders a comfortable feeling and helps with the onset of sleep. Stepping into a warm bed can unfortunately interfere with the cooling off of the body that is required to fall asleep. It disturbs our sleep rather than helping it, just as a bedroom that's too warm can prevent our body from maintaining the right temperature for sleep. [18] [20]

#### Noise

Noise can also be a double-edged sword. Too much or unexpected noise can ruin our sleep, yet certain regular sounds, for example distant background traffic, can lull us to sleep and block out unwanted sounds. [18] [20]

#### Air quality

To ensure good sleep, the bedroom needs to be well-ventilated and have a consistent temperature.



#### Moodmixer, Philips Next Simplicity concept [23]

The Moodmixer offers touch-sensitive control of the ambient lighting around you. It allows you to adjust the lighting ambience in your room with just the tips of your fingers.

Figure 5: Mood mixer, Philips Next Simplicity 2005

#### Air Tree, Philips Next Simplicity concept [23]

The Air Tree takes its cue from nature and keeps the home environment fresh by performing much the same function as a biological tree: filtering the air to keep it clean.



Figure 6: Air Tree, Philips Next Simplicity 2005

# 3 Existing solutions for stress and sleep problems

Our lives no longer have space for the regular, natural routines that are the basis of good sleep and the efficient handling of stress. In recent years, different types of solutions have been proposed in an attempt to remedy the situation. These solutions range from options for escape to teaching people to listen to their bodies.

This chapter looks at three categories of solutions.

1. Withdrawal when needed.
2. Using fixed routines to regain the balance in our lives.
3. Solutions based on knowledge about stress and sleep to become more aware.

## 3.1 Withdrawal when needed

Our complex society produces many stressful situations in which we can no longer consciously – or unconsciously – handle the overload of stimuli projected at us. Many people feel that it's time to unwind, relax and escape fixed daily routines completely.

For many, the trend is to take regular short breaks. Some practical idealists leave their normal lives behind to experience another one, for instance through voluntary work or a retreat in a monastery. The media has picked upon this need and offers television shows based on people breaking with their habits temporarily; for example, putting a group of people on a deserted tropical island, or temporarily swapping family members. Internet-based escapes such as World of War Craft and Second Life also offer us the possibility to break with our normal lives.

In more everyday life, redesigning an interior, discovering a new environment or even wearable solutions can enable people to escape and find their balance again.



### Blanket Chair, Sophie van Heijningen [34]

A chair with upholstery that can easily be changed into a warm blanket.

Figure 7: Blanket Chair

### Soft Therapy, Philips Next Simplicity concept [23]

Soft Therapy is a wearable cordless garment that is soft to the touch. It reduces tension in strained muscles and joints in the shoulders and back by combining infrared heat and vibration massage. Designed for both home and domestic use, it can be worn over clothing or directly against the skin.

Figure 8: Soft Therapy, Philips Next Simplicity 2005



### Environment

People have always tended to take a nap in environments, like trains, planes or waiting rooms. But it is also possible in places that would initially appear to be less suitable, such as the office.

### Clothes and accessories

People can also withdraw into their own body and mind when surrounded by clothes, accessories and other body devices. Philips Design has developed a 'Feel Good' kimono concept that combines tradition and technology to enhance the well-being and comfort of the user. The cream-colored kimono has a conductive, embroidered spine at the back that disperses an electrostatic charge via the fibers on the inside. This creates a tingling sensation that relaxes the wearer. Inside the pocket, a remote device with a number of different settings enables the wearer to select various levels of relaxation.

### 3.2 Fixed routines

To regain their balance, some people use solutions and services that help to force new (fixed) routines upon them.

### Forced routines

Alarm clocks are often too easy to turn off, which leads to dozing and, eventually, falling back to sleep again. The Anemone Clock (figure 9) is an alarm clock with a personal touch. Unlike other alarm clocks, it offers a challenge because, when the alarm goes off, it rumbles intensely and bounces away from its nighttime location, thus making it harder to find the 'Off' switch. It may even bounce so far away that it forces you to get out of bed and chase it around the room. [31]

WorkPace® is an RSI prevention software program developed to help people suffering from the physical effects of work-related stress who need to stop and take breaks from working with a computer. The WorkPace® alerts them that they should take a break, and can even block the computer to force them to stop. It's been noted, however, that this is often neglected because it causes irritation and more stress.

### 3.3 Asking the experts

When confronted with the more serious effects of stress, people often consult experts to help increase their awareness and learn new routines and habits. Such experts are increasingly offering multidisciplinary care. For instance, physiotherapists will work with psychologists or relaxation experts, because many people who think they only have a problem with their muscles are actually suffering from stress. [25] [26]

#### Creating awareness

A great deal of what such experts do is support awareness creation. Often simple tasks such as keeping a diary help people to learn to see that their activity, nutrition, stress and sleep are interrelated. [28] Once they become aware of their patterns, they are offered exercises and tips – a weekly yoga course, for example – that will help them to change old lifestyles and habits and adopt new ones so they learn how to relax their bodies and let go of daily annoyances.

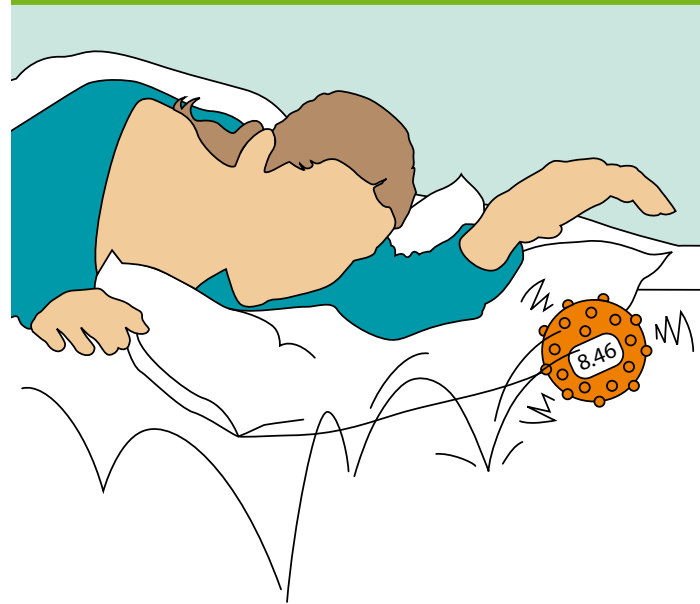
#### Creating new habits

When tackling sleep problems, people can visit a sleep center, talk to an expert or even follow a home-course such as the one offered by Teleac in the Netherlands. [27] At sleep centers, people are taught that an important aspect of sleep is that it is active and not passive, and that it can be influenced by learning behaviors. Sleep center courses are based on making people aware of their sleep patterns by providing the right feedback and monitoring.

### The Anemone Clock, Aaron Tang [31]

A new type of alarm clock that is dynamic, effective and which sometimes forces you out of bed to catch it!

Figure 9: dynamic alarm clock



According to sleep experts, sleeping properly is strongly related to building a strict daily routine, called sleep 'hygiene': 'things to do' and 'things to avoid' before going to bed. [18] [20] [23] [26] these include:

- Going to bed and getting up everyday day at the same time.
- Establishing a regular bedtime routine.
- Using relaxation techniques (or meditation) shortly before sleep.
- Allowing at least one hour unwinding before bedtime.
- Avoiding large meals within one hour of sleep.
- Taking regular exercise, preferably in the morning.
- Avoiding exercise at least one hour before sleeping.
- Avoiding stimulants, such as caffeine and alcohol, at least one hour before going to bed.

### Monitoring therapies

These are therapies that commonly provide biological data as feedback on people's sleep to reassure them. The measurements can show that they sleep better than they think. Presently this feedback is given only in a sleep clinic, where the required monitoring equipment is available.

People who choose such help often felt the need to take action because their sleeping issues had become serious. What is required are devices that would enable such people to gather biological feedback much sooner and, preferably, in their own homes. Devices are currently in development that will enable distance monitoring to make the services offered by a sleep center more accessible to a wider audience at an earlier stage.

### 3.4 Doing It Yourself

To help people tackle their stress and sleep problems in their daily environments, different solutions based on expert knowledge should be developed. This is an area where more focus is required, in order to empower people to get to grips with their own situation without the need for too much external guidance. An example of this would be something that allows people to wake up in a natural way.

### Waking up 'naturally'

When people wake up in their own time, rather than being woken up by an alarm clock, they invariably feel more energized. There are currently many solutions available that use light to wake us up gently by influencing our sleep stages. It might also be possible to use sound (birds chirping) or smell (fresh coffee) to achieve the same effect.

Philips, like several other companies, has developed a light that wakes the sleeper naturally. Half an hour before the chosen wake-up time, light gradually increases to the intensity selected the night before by the sleeper. As it falls on the sleeper's eyes, it sends the brain a message to reduce the production of melatonin and to increase the production of cortisone, resulting in a better balance of natural hormones and a feeling of increased energy. Although it is able to influence people's biology, these solutions are not yet based on people's own biology.



#### Wake-Up Light, Philips [35]

The Wake-up Light gradually increases the light in your bedroom so that you start the day with as much energy as you would on a sunny morning. The benefits are medically proven.

Figure 10: Wake-up Light, Philips Lighting, 2007

## 4 Towards natural tuning

As already outlined in this paper, people often find it hard to dedicate time to address health issues in their hectic lives. By not acknowledging that they may have problems, they put themselves at risk. But many proposed solutions have little relevance to everyday reality and people's true needs. Even though lifestyles have become more unpredictable, human biology has not.

The key to success will be how well companies implement the biological signals as the basis of their solutions, how well they relate them to natural demands. What people need, to be able to tune their lives, are solutions that offer them the chance to adjust their behavior in a flexible manner that suits their needs.

This chapter looks briefly at some of the different steps which can be taken to change unhealthy lifestyles and prevent further, more serious conditions developing.

### Following lifestyle change

We have identified 5 stages of lifestyle change with their particular types of needs based upon several existing models [28] [29]:

1. Receptiveness: finding triggers to make people receptive to an issue.
2. Understanding: providing relevant information.
3. Acknowledgement: linking this information to the individual's personal situation and learning how it relates to their behavior.
4. Explorative behaviour: giving people assistance in finding out what they can do to help themselves.
5. Ritual: enabling people to embed new learnings as part of a daily routine.

Most people could use support when going through these phases, whether through triggering, motivation or helping them to overcome obstacles. A supportive context is of key importance, as are enabling services and solutions that can give them the right information and tools to become aware of their behavior and start experimenting. In the next chapters we examine a number of possibilities.

It is important to find personal solutions that can be fine-tuned according to personal input, relevant information and trustworthy advice. Providing a combination of information, feedback and tools across stages of change highlights the importance of a system-based approach. To provide this, different partners – from care experts to content experts to technology – and service providers – will have to team up.



Figure 11: Process of lifestyle change



#### **Take Care, Philips TODOSO 2006 concept [36]**

By carrying the small portable pod on the move, one can look after his health everywhere anywhere. The pod contains monitoring technology to measure all intentional and unintentional activity to determine the contribution to overall health.

The pod also has galvanic skin sensors integrated into its surface so it can detect stress levels when the owner holds it. A display on the pod surface gives feedback on stress levels. If the owner wants to, he can carry out some simple and discrete relaxation exercises on the spot to calm down.

Figure 12: Portable pod on the move, Take Care,

#### **4.1 Receptiveness, understanding and acknowledgement**

In the first stages of change, it is important to make people receptive to change in the first place by triggering people about their health situation in an enticing way. Only then it starts to get personal meaning. This allows people to get aware of their health situation and personal consequences on the long run. It is a prerequisite to acknowledge the need for change, which encourages people to start carrying out relatively small adjustments.

Philips can help people become aware of their own behavior and problems by offering tracking devices that make lifestyle behavior visible, relevant health information meaningful, and the health network of people accessible – whether scientists, professionals, peers or people coping with the same issues. [28] [29]

Improving your health starts by learning to listen to your body. This can be achieved by personal and flexible solutions showing people what their body tells them through measurable biological signals, and guiding them on the spot through bio-feedback techniques that train individuals to improve their health.

It is important to offer the possibility of ‘sneaky triggers’ to people on the move, allowing them to improve their health in short accidental occasions during the day. This can be achieved by offering flexible and wearable solutions. These solutions playfully educate people in how small choices and actions do indeed add up to a healthy record and can make a difference. An example of just such a device is the Take Care concept, used to measure activity and stress [36].

Interapy online psychiatric counseling, UVA offers connected solutions that can lower the threshold and make people act upon their condition in an early stage. This can prevent serious disorders in the long run. [33]

#### 4.2 Exploring lifestyle change behavior

The use of a monitoring device at home is not uncommon: think of other home devices such as bathroom scales or thermometers. Scales are easy-to-use devices that enable us to objectively monitor our body weight and enhance a healthy lifestyle in combination with attention to food intake, movement and exercise. Although not so routine, the thermometer is a device we use when unwell to easily confirm or disprove our subjective feelings.

##### Support napping

If it coincides with the natural post-lunch dip, a short nap can be very refreshing, especially if it is held just long enough for the body to relax and recover. So it is important to monitor the best time to wake up and ensure that we do so properly refreshed. For instance, in some parts of Spain people nap with a key chain in their hands. When they reach the stage at which their muscles relax, the keys slips out of their hand and falls to the ground: the noise it makes wakes them up and ensures that they sleep just enough to be refreshed.

As napping often occurs outside the bedroom, people should be able to use devices as flexibly as possible – in different places, including public places, and at various times – to meet different needs for sleep.

##### Offer links to experts

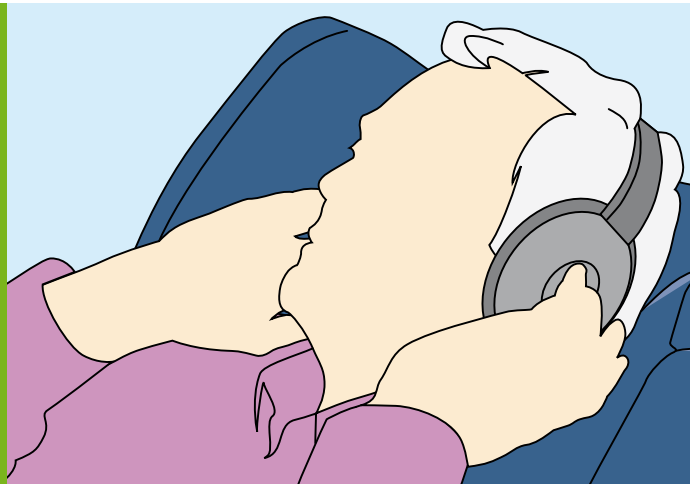
Monitoring devices should be able to provide feedback to people with sleep and stress problems, but should also be able to treat more disorders if possible. The data could be given directly to medical staff as part of a remote rehabilitation program or common health monitoring or, in less acute situations, people could use it to give the expert more insight into their individual living patterns during a consultation.

The data provided by design solutions should be able to detect patterns, but users should also be able to add other lifestyle data for example; what they've eaten, how they have slept and if they have moved sufficiently. Such data is related to lifestyle choices and can be part of a program to improve sleep and diminish stress by improving lifestyle behavior.

### BodyResT, Sonic Studio [37]

A wearable device that produces customized music for relaxation and prepares the wearer for sleep. Thanks to its built-in bio feedback system, music changes in real time according to the listeners' physiological parameters; for example, their stress levels. The music does not have beginning or end, it sounds different every time. Its developers call it 'just-in-time-composition'.

Figure 13: Wearable relaxation device



### 4.3 Rituals

People need to make the new learning part of daily life. Light seems to help people in a natural way. But, in combination with detecting the biological stages, a device should be body-driven rather than time-driven. It is important that someone wakes up at the right moment, a moment determined by biological body rhythms.

Philips' Take Care concept offers a design solution that wakes you up at the right moment according to your biological data, nudges you pleasantly into the new day, feeling full of energy after a good night's rest. To help people adopt new habits, the whole system is designed

around the everyday environment in which it is used, with the light being projected from the bedside table and the ceiling used as a screen. Daily feedback on relaxation, activity and sleep could be provided on a multi-purpose 'smart' mirror in the bathroom, a place visited daily and already part of everyone's routine.

#### Address the senses

Relaxation to recover from a hectic day away can be optimized when the body's senses are addressed naturally. As it is important to unwind before going to sleep, even in irregular schedules, lights, colors and smells can all help to place people in a different body and mindset.



### Take Care, Philips TODOSO 2006 concept [36]

The imbedded sleep tracking system of Philips' Take Care can be used to wake up people in Light Sleep. This will benefit people during the day. When the system tracks Light Sleep around the preferred wake-up time, the room lights will gradually become brighter, in daylight colors.

Figure 13: Wearable relaxation device

# 5 Conclusions

There has obviously already been a great deal of time, effort and resources invested into tackling issues relating to stress and sleep. However, it would seem that the problem is becoming more acute rather than easing. This would suggest that conventional approaches, while offering a certain degree of relief, have not always been able to address the root causes.

People are often not aware of their own habits and behavior, and don't recognize the symptoms of negative stress. Such misconceptions can cause them to not take action in time or set unrealistic goals for themselves. When developing a solution for stress and sleep problems, it is therefore important to help people to find a new balance in their existing social context. Viable solutions need to accommodate relaxation, de-stressing and sleep outside the usual hours.

To support people in this, natural tuning should be the starting point. Proposals are more likely to succeed if they are highly individualized and open, so users can personalize them to suit their own situation. As our world changes, different people will need more flexible solutions, which they can calibrate for maximum effect when required; hence the term 'natural tuning'.

By allowing room for natural tuning, there is real potential to properly address stress and sleep issues without the need for a drastic overhaul of existing lifestyles. This empowers people to act before long-term issues take hold and problems become more acute.

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