

A Detailed Analysis of RSIGuard's BreakTimer Functionality



A Remedy Interactive Publication

June 2007

Remedy Interactive
480 Gate Five Road, Suite 130
Sausalito, California 94965
(415) 332-6433
www.rsiguard.com

Remedy Interactive Proprietary

©2004-2007 by Remedy Interactive, Inc.
All rights reserved.

The information contained in this document is proprietary and confidential to Remedy Interactive, Inc.

This document is subject to change without notice. Remedy Interactive does not warrant that the material contained in this document is error-free.

About Remedy Interactive

Remedy Interactive is the leading provider of software that streamlines ergonomic programs in large organizations, globally. The Company's flagship product, the *Office Ergonomics Suite* (OES), assesses risk, trains employees, optimizes work patterns, and collects data to enable organizations to focus their resources, automate their ergonomics programs, and ultimately reduce costs. The OES's management features are designed to allow companies to do more with less by harnessing the potential of automation.

Remedy Interactive's *Office Ergonomic Suite* is the winner of the 2002 National Ergonomics Conference Attendees' Choice Award for Product Most Likely to Improve Profitability and Productivity.

Remedy Interactive works with Fortune 1000 clients including Hewlett-Packard Company (NYSE: HPQ), ChevronTexaco (NYSE: CVX), and VISA.

For more information, please visit www.rsiquard.com or call (800) 776-5545 or (415) 332-6433.

Table of Contents

Introduction	4
Establishing the Need for BreakTimer	4
What does a SABRS do in general?	5
What does the RSIGuard SABRS (BreakTimer) do?.....	5
• Accurate strain measurement	6
• Average work measurement	7
• Speed of strain accumulation.....	7
• Natural break measurement	7
• Maximum time between breaks	7
• Minimum time between breaks	8
• BreakTimer filters – There are situations where interruption is unacceptable and can lead to rejection of a SABRS. While the situations may be rare, they can have significant negative impact on software acceptance. BreakTimer filters let you specify conditions in which the BreakTimer should either not interrupt the user, or should use “polite mode” (see below). For example, during a PowerPoint presentation, it is not appropriate to ask a presenter to take a break. The filter for this is one of the defaults built into BreakTimer, but you can add others as appropriate.	8
• Preparing users for breaks.....	8
• Polite mode / Break suggestion intrusiveness level	8
• Adjustable break enforcement	9
• Managing poorly timed breaks.....	9
• Work restrictions	9
• AutoClick and KeyControl integration	9
• Self-timed breaks	9
• Break logging.....	9
• Multi-user support	9
• Multi-computer support	10
How Does BreakTimer Measure Strain?	10
BreakTimer’s Work Restriction Feature	10
• Variable restrictions	11
• True time or Strain time	11
Stretches During Breaks (RSIGuard Stretch Edition only)	11
ForgetMeNots	12
Conclusion.....	12

Introduction

Remedy Interactive's RSIGuard software is the leading ergonomic intervention application for the office environment. RSIGuard includes many components, including BreakTimer, KeyControl and AutoClick functions. This document discusses in detail the principles behind RSIGuard's BreakTimer feature and compares it to other break timing features in other software. Documentation on how to use and setup BreakTimer can be found separately at <http://www.rsiguard.com/helpbt.htm>

Establishing the Need for BreakTimer

The U.S. Bureau of Labor Statistics reports about 520,000 cases of lost work-time due to repetitive strain injuries (RSIs) each year¹, and the National Research Council estimated the annual economic burden – including compensation costs, lost wages, and lost productivity – to be between \$45 and \$54 billion.² Although various ergonomic aids exist (e.g., alternative keyboards, chairs, adjustable desks, anti-inflammatories), ergonomics professionals strongly recommend rest breaks as a core element of an ergonomics program to combat RSIs.

In some industries there is a dilemma regarding regular breaks because they are easily forgotten or ignored. Computer users have the obvious potential advantage of using a software-assisted break reminder system (SABRS). The advantage of a SABRS is that breaks are not only remembered and potentially enforced, but also that the breaks can be sensibly timed to help prevent RSIs and minimize work disruption.

Although some users don't appreciate interruptions, many leading organizations prevent RSIs by incorporating breaks into work schedules. This approach supports the financial objectives of the business as well: a study funded by the U.S. federal government revealed that taking regular rest breaks can actually improve worker health without lowering productivity³. In addition, a study from Cornell University concluded that rest breaks actually increased productivity.⁴

¹ Bureau of Labor Statistics, U.S. Department of Labor, Incidence Rate reports, 2001.

² *Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities*; Panel on Musculoskeletal Disorders and the Workplace, Commission on Behavioral and Social Sciences and Education, National Research Council; published by the National Academies Press, 2001.

³ May 22, 2000, news release from the National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services.

⁴ Cornell Human Factors Laboratory Technical Report RP9991, Cornell University.

What does a SABRS do in general?

All SABRS make it easy to remember breaks because the computer acts as an infallible “reminder agent”. Each SABRS uses some algorithm to determine when to suggest breaks to the user – and that algorithm is a significant differentiator between various systems.

For example, if a break is given when a user feels it is inappropriate, it leads to rejection of the SABRS. Building trust by suggesting breaks at appropriate times leads to greater compliance with the SABRS-suggested breaks.

All SABRS attempt to model when the user should take a break. The simplest models use a time interval. For example, they might tell the user to take a break every 60 minutes. These systems do not consider that the user may have been on the phone or at lunch for 50 of the last 60 minutes, and can be very annoying since they often ask the user to take unnecessary breaks. If a user is doing particularly intensive work, more frequent breaks would be appropriate – something for which a time-interval model does not account. Many organizations using this type of model will experience a high software rejection rate among employees.

Other SABRS use models that count keystrokes and/or mouse actions. This is an improvement because it ties break timing to the user’s activity – although they generally don’t consider the intensity of work (e.g., did the 1000 keystrokes occur over 30 minutes or 4 hours).

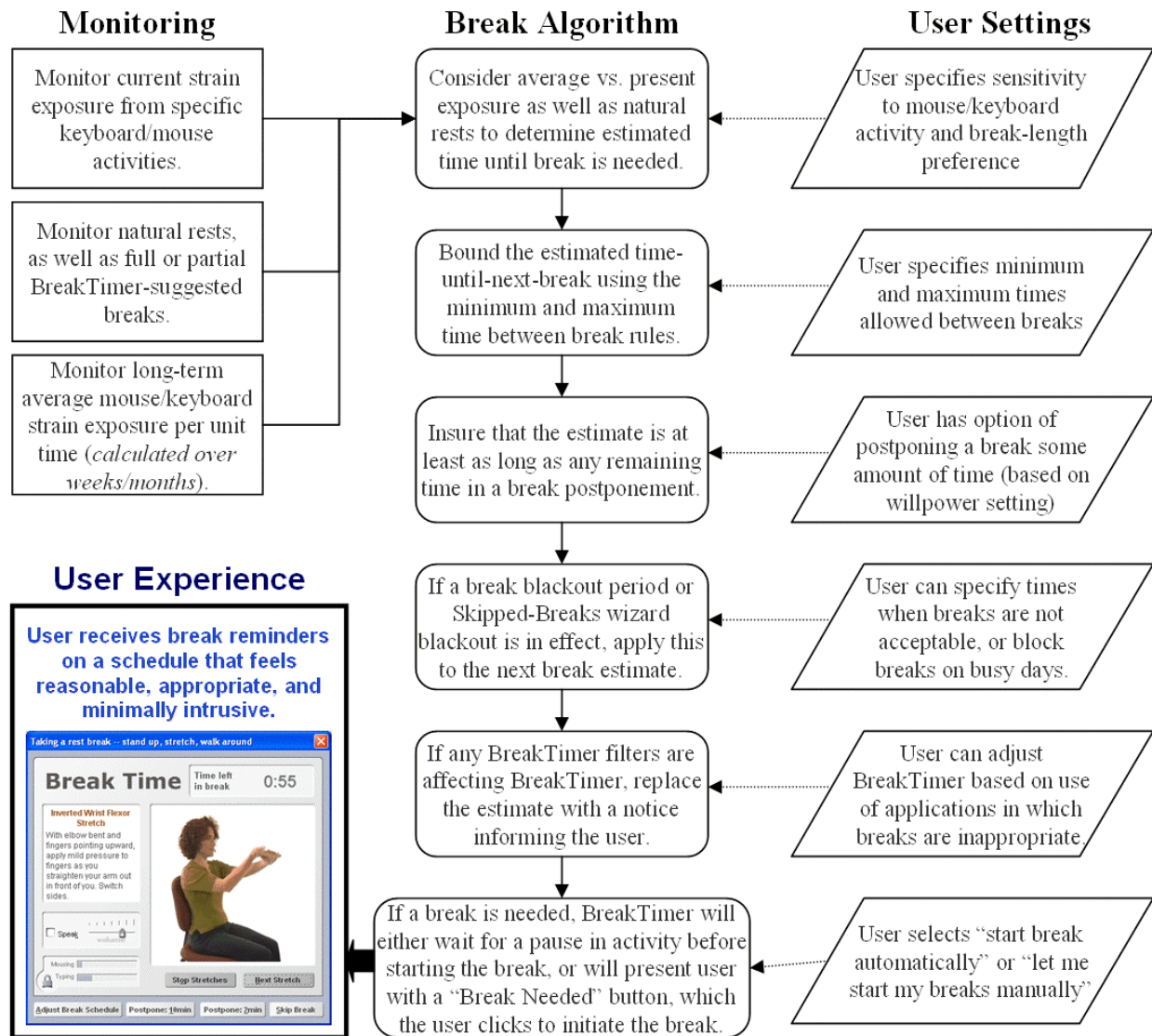
Some models go further by watching rest time as well, and count a long rest as a break taken. Thus, if the user rests on their own (natural breaks), the SABRS will reset the timer, leading to less frequent breaks. However, no credit is given for rests under the threshold time, and no consideration is made of work intensity.

What does the RSIGuard SABRS (BreakTimer) do?

RSIGuard’s BreakTimer considers each second of computer activity and inactivity to maintain a dynamic model of work and rest patterns. In addition to time of work and rest, BreakTimer also looks at keystrokes and mouse activity. Rather than simply counting them, however, it uses a strain model that considers what keys were pressed and what mouse actions were performed and each of these strains your body differently. Furthermore, RSIGuard’s BreakTimer has various intelligent components designed to improve the timing of breaks, the palatability of breaks, as well as the ease of configuring such a sophisticated system.

Below is a flowchart that describes the overall concept of the BreakTimer followed by a more detailed description of the many components of the BreakTimer system. While it might seem complex, remember that the user’s experience is simple – intelligently timed, less-intrusive break suggestions.

BreakTimer Overview Flowchart



- **BreakTimer setup wizard** – The setup wizard provides a simple 4 step wizard that lets most users reasonably configure User Settings without understanding the complexity of the model or the full range of possible configurations. Users who need more specific control can adjust the BreakTimer settings directly.
- **Strain compartments** – BreakTimer models strain associated with mouse and keyboard activity separately to represent the different muscle groups properly. Settings allow a user to set the BreakTimer sensitivity based on their personal physical health. Users can also specify whether they prefer more frequent shorter breaks or less frequent longer breaks.
- **Accurate strain measurement** – Different keystrokes require different levels of physical strain. RSIGuard models strain from different keystrokes based on the

difficulty in pressing the key, and this model was developed from a surface electromyography (EMG) baseline study. For example, pressing Ctrl-C requires more muscular effort than Ctrl-F5, and pressing Shift-G requires more muscular effort than just pressing G. In addition, differing levels of strain from different mouse activities are accounted, e.g., single-clicking is easier than double-clicking; moving the mouse while dragging is harder than just moving the mouse. This approach is more accurate than a mouseclick counter. For example, consider a drag and drop action as compared to two single clicks: a mouse click counter would consider two single clicks as being twice the activity of a drag and drop action, while in reality a drag and drop is much more straining.

- **Average work measurement** – BreakTimer monitors the intensity of a user’s typical work session. When the user works more intensely than usual (or less intensely), BreakTimer automatically adjusts the break frequency. This measurement is also used for work restrictions (more information on work restrictions follows in a later section.) This is an important distinction from keystroke/mouseclick counters, because few people know what their average keystroke or mouseclick rate is.
- **Speed of strain accumulation** – This feature measures the absolute speed of strain accumulation (average strain experienced per unit time) and accordingly adjusts frequency of breaks. This ensures that on average breaks occur on a relatively stable schedule, but they do occur more frequently as the user works more intensely than usual – and vice versa.
- **Natural break measurement** – BreakTimer analyzes each second of work and rest separately for the mouse, the keyboard, and for the two combined. For example, accumulated mouse strain can be reduced while typing, and vice-versa, even though the break model still considers that, overall, you are still at work on the computer whether you are mousing, typing, or alternating between the two. This teaches users that they can avoid break reminders by varying their activities (alternating mouse and keyboard tasks as well as switching between computer and non-computer tasks).

The longer and more frequently a user takes natural breaks, the more “credit” BreakTimer gives – providing users the positive feedback of fewer interruptions as encouragement towards developing good break-taking habits. Although the credit BreakTimer gives for natural rests is non-linear (i.e. longer breaks get more than proportionally greater credit), a rough guide is that a natural pause of about 1.5 times the user-selected average break length will be treated similarly to a full BreakTimer-suggested break.

- **Maximum time between breaks** – Because fatigue from extended sitting and eyestrain (and other static exposure) is more a function of time at the computer than of keystrokes and mouse activity, BreakTimer allows the user to set a “maximum time without a break.” If a user works longer than this time, a break is

triggered. This is not the same as triggering a break every X number of minutes, because these breaks will not be triggered if natural breaks are taken or if breaks are triggered earlier as a result of keyboard or mouse strain.

- **Minimum time between breaks** – BreakTimer lets a user specify a minimum amount of time between breaks. This time lets a user specify that even if they have accumulated high levels of strain, no breaks will be given. Ideally a user won't use this to avoid breaks, but it can help users avoid the frustration of too frequent breaks.
- **BreakTimer filters** – There are situations where interruption is unacceptable and can lead to rejection of a SABRS. While the situations may be rare, they can have significant negative impact on software acceptance. BreakTimer filters let you specify conditions in which the BreakTimer should either not interrupt the user, or should use “polite mode” (see below). For example, during a PowerPoint presentation, it is not appropriate to ask a presenter to take a break. The filter for this is one of the defaults built into BreakTimer, but you can add others as appropriate.
- **Preparing users for breaks** – An important part of making breaks less intrusive is to let users prepare for upcoming breaks. RSIGuard addresses this in several ways to avoid surprise interruptions. The RSIGuard window shows an *estimate* of how long it will be before the next break is triggered (as well as how long it has been since the last break). This estimate updates dynamically as the user takes natural rests or adjusts work intensity. It also accounts for minimum and maximum time between breaks and break postponements. The RSIGuard icon (in the system tray) blinks and an optional tone sounds shortly before RSIGuard estimates a break will occur. RSIGuard will also delay starting a break by a short time to try to look for a natural pause in the users work. This prevents a break from interrupting a user in the middle of writing a sentence or in the middle of a mouse operation.
- **Polite mode / Break suggestion intrusiveness level** – Ideally, breaks should be taken as BreakTimer suggests them. Although ideal, this method can be too intrusive to be practical for some employees or for certain job descriptions. For example, a 911 operator cannot simply take a 4 minute break whenever BreakTimer suggests it. Also, some employees will simply not tolerate break interruptions well, but they still need the benefit of break timing. During the initial setup wizard, BreakTimer will allow the user to determine if breaks should begin as soon as BreakTimer deems it is break time (greatest benefit but more intrusive), or if at break time BreakTimer simply displays a “Break Needed” button (non-intrusive). When the “Break Needed” button is clicked, the break begins – but the user will not be interrupted until the button is clicked. Users can also select a “compromise mode” in which the break will eventually occur if the button is ignored for several minutes. Several other adjustments in the BreakTimer settings screen can be configured to reduce break intrusiveness.

- **Adjustable break enforcement** – Because the enforcement of breaks can be a source of frustration to users, RSIGuard allows a user to specify their “willpower to respect breaks.” If a user has good willpower, RSIGuard makes it easier to bypass breaks. If a user specifies that they want more enforcement, RSIGuard will make it more difficult to bypass breaks.
- **Managing poorly timed breaks** – When a break is triggered, the user may simply not be able to stop at that moment. The user has the option of postponing breaks. The amount of total time a break can be postponed is dependent on the willpower setting. When a break is postponed, BreakTimer continues to measure strain. If the user incurs more strain, the postponed break will be appropriately longer. If the user spends enough of the postponement resting, the break will properly not occur. In addition, the “End Break Early” feature allows a user to completely skip a break and artificially lower the measure of accumulated strain.
- **Work restrictions** – A frequent prescription issued by physicians for injured workers is to restrict their use of the computer to a certain amount of time per day. BreakTimer not only allows a user to monitor a basic hourly restriction, but also allows the user to adjust the restriction based on either the day of the week (i.e., Monday, Tuesday, etc.) or whether preceding days were spent working or resting. In addition, instead of a time exposure limit, work restrictions can limit a user to a particular level of strain exposure. More detail about the work restriction feature appears below.
- **AutoClick and KeyControl integration** – The AutoClick and KeyControl feature of RSIGuard are integrated with BreakTimer, so that as users depend more on these features, they can work longer without a break. (For a detailed analysis of the AutoClick feature, see <http://www.rsiguard.com/AutoClickAnalysis.pdf>).
- **Self-timed breaks** – When a user wants to take a break, he or she can request the “Take a break now” feature of BreakTimer, either by selecting it from the main menu or by pressing the take-a-break-now hotkey. This forces a break to occur immediately. Although BreakTimer would already treat time away from the computer as a break, this lets users tell BreakTimer that it can lock out the computer – and show stretches in RSIGuard Stretch Edition.
- **Break logging** – BreakTimer logs the number of breaks taken per day via the DataLogger feature. It also logs the number of breaks that are ended early, the amount of time that breaks are postponed, and the amount of time spent taking breaks. (For a detailed analysis of the DataLogger feature, see <http://www.rsiguard.com/DataLoggerAnalysis.pdf>).
- **Multi-user support** – BreakTimer can handle an arbitrary number of users simultaneously on one computer without any additional strain on the processor. As one user switches to another and switches back later he or she will notice that

the computer has continued to monitor his or her strain level even while someone else was using the computer. If a user turns off the computer for a while and restarts it later, the model will properly account for “off-time” as time away, just as it would if the user had left the computer on.

- **Multi-computer support** – If DataLogger stores its data on a network, BreakTimer can be configured to calculate break timing based on a user’s activity on multiple computers. Thus, if a user’s breaks normally occur on average every 40 minutes, and they spend 20 minutes (working at an average pace) on one computer followed by 20 on another, BreakTimer will detect this and tell him or her to take a break.

How Does BreakTimer Measure Strain?

BreakTimer works by modeling a user’s “strain.” Strain is a measure of the absolute quantity of exposure to straining activity. Because there is no standard unit for defining strain, RSIGuard defines its own standard.

There are two types of strain that are modeled – strain from using a keyboard and strain from using the mouse. The basic keyboard strain unit equals the amount of strain from pressing the letter ‘f’ with the left-hand’s pointer finger. The basic mouse strain unit is defined as the amount of strain incurred from moving the mouse (without clicking) for a time of 1/10th of a second.

The values for various activities were derived with a baseline surface-EMG study of several computer users. Although the defined strain units do have a theoretical absolute value, each person is different – both physiologically and in the way they work – so the values RSIGuard uses are only approximations. However, the relative measure of a user’s strain from day to day can be compared meaningfully. This allows BreakTimer to know whether a user is working more or less throughout the course of the day and whether their long-term intensity of work (strain per unit-time) is changing.

BreakTimer’s Work Restriction Feature

Doctors frequently prescribe work restrictions for injured workers in order to reduce strain exposure. Although the typical prescription is to require users to reduce their workload from their current “hours of work per day” to a “reduced hours of work per day,” most doctors agree there are problems with this solution.

First, many workers don’t know how many hours they spend on the computer per day, especially since it is often different every day. This makes it difficult for a doctor to prescribe an intelligent reduced number of hours. RSIGuard’s DataLogger accurately measures how much a user works per day, the intensity of that work, and also separately monitors the length and intensity of mouse and keyboard use.

Secondly, without DataLogger, this lack of awareness of how long they work prevents most people from reducing their number of hours to follow prescribed reductions. BreakTimer's basic work restriction feature alerts the users when they have reached their prescribed limits. This basic version of work restrictions is available in several other programs as well.

Thirdly, many doctors recognize that a fixed number of hours is not an ideal prescription, but that to make a more complex restriction is useless since it is difficult to follow even the most basic restriction. BreakTimer's advanced work restriction feature has two features that make work restrictions much more meaningful and useful:

- **Variable restrictions** – Users can select either to specify a different work restriction for every day of the week (normally restricted to fewer hours towards the end of the week) or to have a dynamic restriction that goes up after each day of rest and down after each day of work. The upper and lower limits, as well as how much the restriction changes each work day and each rest day, can be defined by the user.
- **True time or Strain time** – A normal work restriction measures the restricted work in terms of actual time. That means that if a user is restricted to four hours of work, he or she can spend no more than four hours at the computer per day, although it can be spread out over the whole day with time away from the computer in-between. BreakTimer reveals that four hours of work one day could involve a lot more strain than four hours of work another day. Therefore, RSIGuard's BreakTimer gives the user the option of limiting work in terms of the amount of average strain accumulated in a certain number of hours. For example, if the user is limited to four hours, BreakTimer will stop the user after he or she has accumulated as much strain as he or she typically experiences in four hours. Thus, if the user is working less intensely than usual, he or she will be allowed to work longer than four hours, and if working more intensely than usual, the user will be allowed to work fewer than four hours.

The main RSIGuard display normally shows how long a user has been working (if the Time Statistics option is enabled, as it is by default.) If a user has activated the work restriction feature, however, the main display will instead show how much time the user has left to work that day.

Stretches During Breaks (RSIGuard Stretch Edition only)

Remedy Interactive offers three versions of RSIGuard software: Standard Edition, Call Center Edition, and Stretch Edition. The Stretch Edition includes high-quality stretches which are shown during breaks. The stretches are accompanied by a text description of the stretch and an optional audio track that guides the user through the stretches. The

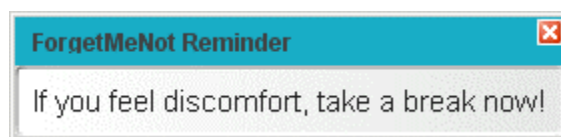
audio track can heard through audio headphones or speakers attached to the user's computer. RSiGuard Stretch Edition is the appropriate edition for most users.

ForgetMeNots

In addition to activity-based BreakTimer-suggested breaks, RSiGuard also offers the ForgetMeNots system.

ForgetMeNots offer users frequent (e.g. once per 15 minutes) time-based reminder messages that help maintain awareness of work patterns. Messages might ask the user to notice something about their posture or ask them to notice about how they feel.

In addition, ForgetMeNots can also ask the user to take a brief (e.g. 12 second) rest from typing and mousing.



Sample ForgetMeNot Reminder

Since the fundamental purpose of ForgetMeNots is to be an awareness reminder, popups are time-based rather than activity-based. However, the ForgetMeNots system is aware of activity and of the BreakTimer break schedule. As a result, ForgetMeNots will not appear right before or after a full break, and may occur less often or not at all if the user is idle for an extended period of time.

Additional information about ForgetMeNots is available at <http://www.rsiguard.net/help/helpfmn.htm>.

Conclusion

RSiGuard software's rich feature set – including the BreakTimer functionality – makes it the industry's leading ergonomic intervention software application. BreakTimer helps reduce or eliminate strain which leads to ergonomic injury. RSiGuard's BreakTimer feature uses a unique and powerful algorithm to calculate strain, and it offers more flexibility and intelligence than any other alternative application. BreakTimer can be easily extended to manage prescribed work restrictions, and RSiGuard is available in three different versions to suit the needs of a wide variety of users and organizations.