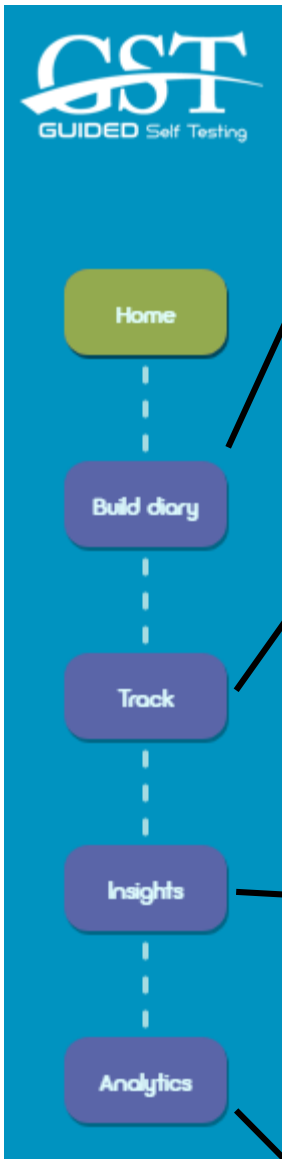


GST: At A Glance

The home page has a brief overview of the GST app. Navigate through the app using either the buttons on the left side of the screen, or the forward/back arrows at the bottom right. There is no login or account. Your browser cache will save diary entries. You can clear your entries with the “Clear all” button (bottom left). You can export your diary from the “Track” page to a CSV file.



- Choose from a selection of common sleep and wake factors you would like to track in your diary. You can define one custom factor in each category (sleep and wake) if you wish. A popup will ask if you want the units to be a number value, or just a yes/no.

- The tracking page defaults to one week, with each day being one row in the diary. You must complete at least one week of entries to see the results on the insights page! Anything less is too hard to interpret, and you will be prompted to complete 7 days.
- Hover over the diary column icons (on browser), or click on them (on phone) to remember what they mean.
- Click on the # circle next to a row for the data entry popup.
- Click + to add more rows to your diary.
- Click “Export CSV” to export your entries into a standard CSV file.

- Correlations are shown in a table for wake factors that were related to sleep factors. The strength of the correlation is given by the medal color (gold = large, silver = medium, bronze = small).
- For medium and small effects, the button on the right suggests how many additional days to record to confirm the link is true (clicking the button will add rows to the tracking page).
- Scroll down to see all possible pairwise correlations in your diary. Here is where you may find “cycles” in your day-night patterns, some vicious cycles, some virtuous cycles!

- Analytics shows the same data in graph form, and simplifies the wake factors by breaking them into “none” or “any”. This is just one other way to look at the data.

This app is not meant to provide medical advice, and has not been validated for clinical use. Anyone with concerns about their sleep should speak with their doctor or trained professional.

GST: Step by step ... Build Diary page

To build your diary, choose the radio buttons next to factors that you'd like to track. Four common examples are available for Sleep and Awake categories of the diary. One additional factor can be defined for each category ("Custom Factors"). When chosen, a popup window (lower image) allows defining the name of the custom factor, and whether the units for the factor will be numbers (like a rating scale), or simply whether the factor was present or not ("yes/no"). In the example below, the green check marks show the chosen variables from the default list, and an additional factor of "Pain" is defined for sleep, on a number scale to rate the severity (in the subsequent screens, another Awake factor, "Yoga" was also defined, with units of "yes/no").

Sleep factors

- Number of awakenings
- Total sleep amount
- Minutes to fall asleep
- Sleep quality
- pain

Awake factors

- Stress
- Caffeine
- Exercise
- Alcohol

[Custom Factors +](#)

Custom factor

Choose answer format

 Number Format Yes / No

Cancel

Submit

GST: Step by step ... Track page

The Track page defaults to a diary of one week duration. Anything less and it is very hard to interpret the correlation analysis. Even for 7 nights, only very strong correlations will turn out to be statistically significant (put another way: 7 nights is under-powered to detect anything other than large effects as significant). Interested users can get more details about this in the accompanying full-length manuscript describing the GST platform (PDF: "GST Platform").

In the diary, each row is one day, with numbers inside circles on the left. Each column is a factor chosen during the build diary step, indicated by the icons. Custom factors have a generic icon for Awake (sun) or Sleep (moon) factors.

The + sign will add more rows to the diary. The "Export CSV" button will place any diary entries into a CSV file for people who want to do their own analysis off-line. Clicking on a number for any row will trigger a popup to fill in the values (lower image), and click submit. Note that 7 completed days of entries are required before the Insights page will display the results!

The image shows a screenshot of the GST Track page. The main interface is a dark blue grid with 7 rows and 6 columns. The rows are numbered 1 through 7 on the left. The columns are headed by icons: a bed with a sun (Awake), a bed with a moon (Sleep), a coffee cup, a wine glass, a sun with sliders, and a moon with sliders. A '+' button is at the bottom left, and an 'Export CSV' button is at the bottom right. A popup window titled 'Day 1' is open, showing a form with the following fields:

- Total sleep amount? 0 hours
- Sleep quality? Good Bad
- How many cups of coffee did you drink? 0 cups
- How many alcoholic drinks did you drink? 0 drinks
- pain ? 0
- Yoga ? yes no

A 'Submit' button is at the bottom right of the popup. A black arrow points from the '1' in the first row of the grid to the 'Day 1' popup.

GST: Step by step ... Track page (continued)

For each row, the values entered in the popup window (see prior page) are now shown as either numbers or, for yes/no factors, as either a “✓” or an “x”.

Suggestion: when filling out the diary, enter the daytime awake factors just before going to bed, as you think back on the day that just happened. The next morning, enter the sleep factors, as you think back on the night that just happened. That data completes one row. Hover (on browsers) or click (on phones) on the icons for a reminder of what they are.

Note: the data is saved in a temporary cache on your device. To save your data, click on the export CSV button. This allows interested people to perform their own analysis. To start over, click “Clear all” in the bottom left of any screen.

Unfortunately, the software does not support importing, or syncing with a device, but if you have a sleep tracker, you can add it’s output manually to the diary, for example as a custom sleep factor. Or if you have a step tracker, you could add that value as a custom Awake factor.

1	6.5	✓	1	1	✓	0
2	7	✓	1	0	✓	0
3	8	✓	0	0	✓	0
4	9	✓	0	0	✓	0
5	8	x	4	1	x	0
6	7.5	x	3	1	x	1
7	8	x	5	1	x	0

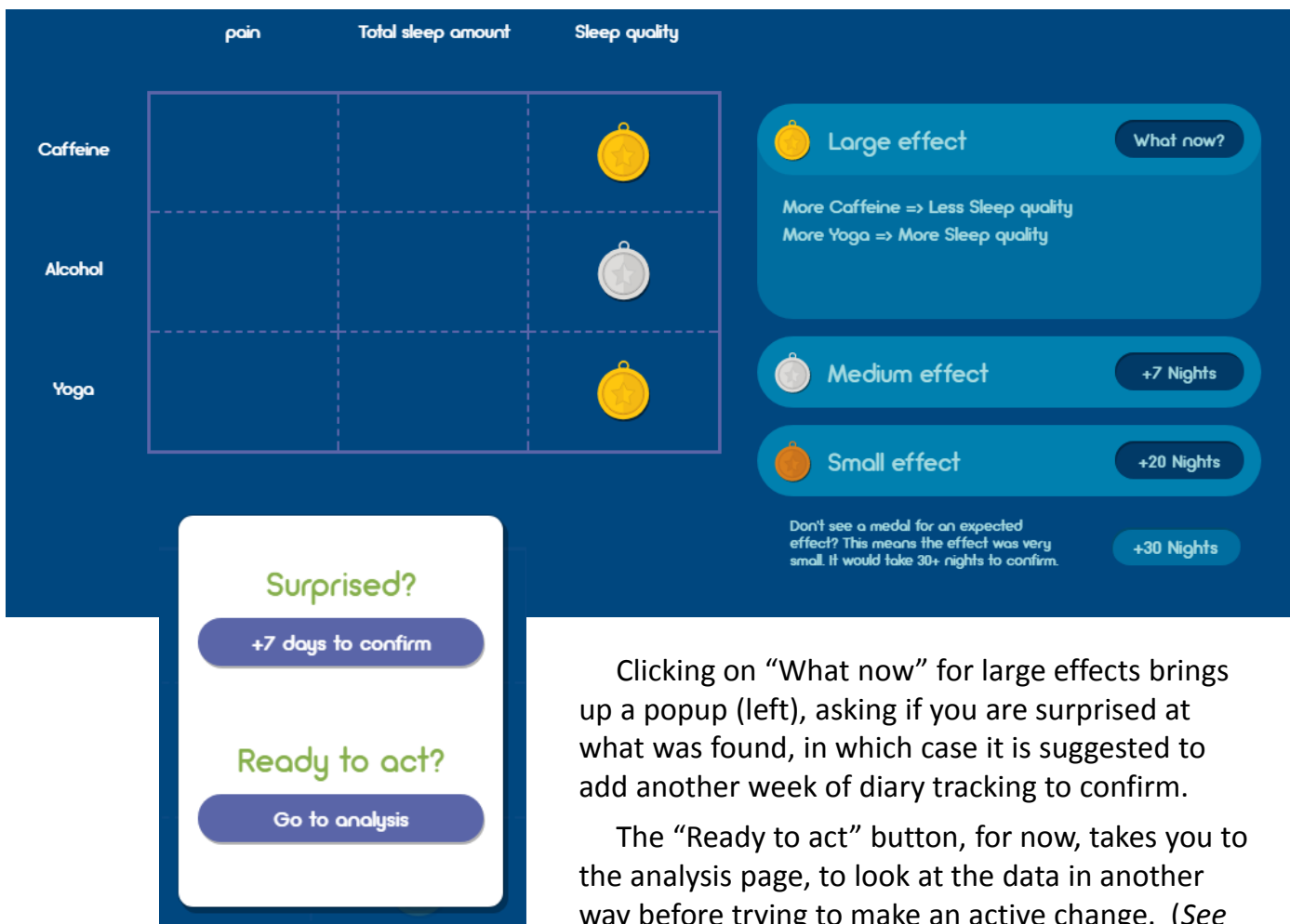
Export CSV

GST: Step by step ... Insights page

Once at least 7 rows of diary data are entered (must be complete data!), the insights page will display a correlation table between the Awake factors (rows), and Sleep factors (columns). In each box of the correlation table, there will be an Olympic medal if a correlation was found: gold for large, silver for medium, and bronze for small effects. If there is no medal present, the correlation value was too small to report.

The text boxes to the right of the correlation table explain the correlations in words. It defaults to show large effect examples. Click on the medium or small button to toggle their view of text explanations. For Medium and Small effects, the button of + nights is the suggestion for how much longer to record the diary to confirm these correlations. This is what's known as a "power" estimation. For one week of diary, only large correlations can reach statistical significance. Medium or small correlations would need progressively more data to "prove" statistically.

If you suspected a correlation, but it was blank (no medal), it either means that the relation is actually very small (and could take months to prove it exists statistically), or that something was different or masked the effect in the available data.



Clicking on "What now" for large effects brings up a popup (left), asking if you are surprised at what was found, in which case it is suggested to add another week of diary tracking to confirm.

The "Ready to act" button, for now, takes you to the analysis page, to look at the data in another way before trying to make an active change. (See *last page of this document for more information.*)

GST: Step by step ... Insights page (continued)

The lower display of the Insights page shows all possible correlations between pairs of diary factors. The colors of the lines follow the same code as the medals (gold, silver, bronze). There are four categories of correlations, which can be toggled by the radio buttons on the right to view or hide.

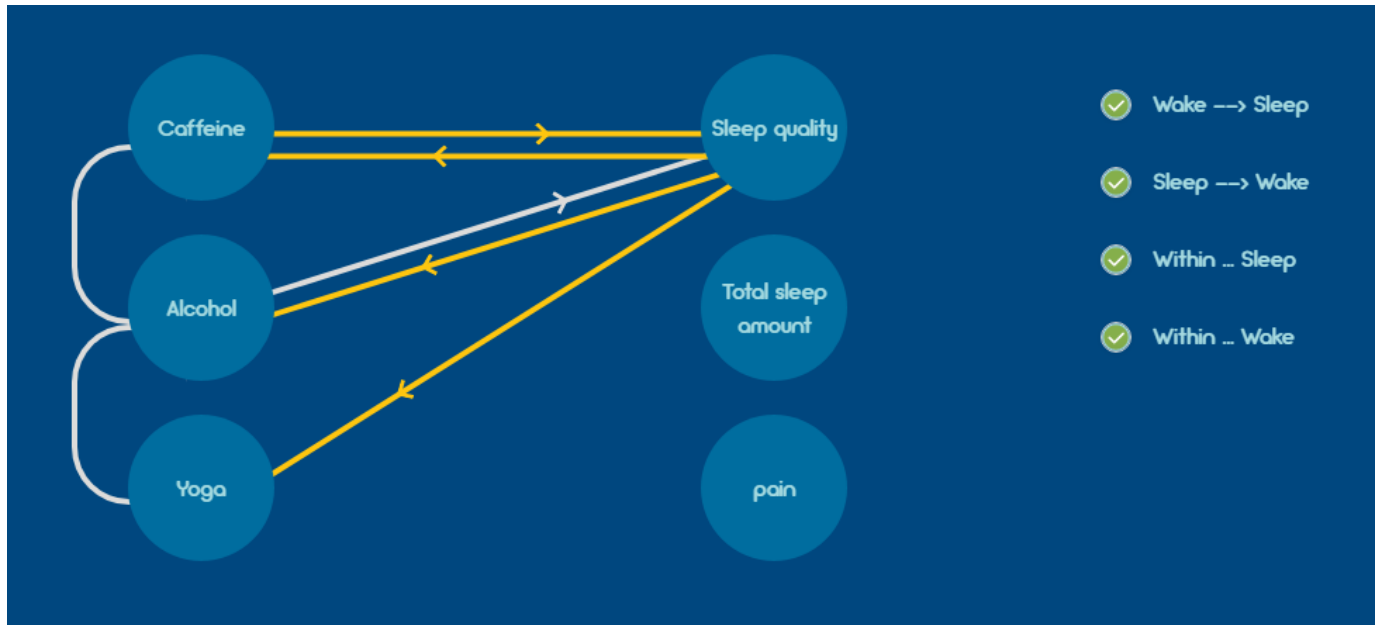
Wake → Sleep: links between an Awake factor and Sleep later that night

Sleep → Wake: links between a Sleep factor and a next-day Awake factor

(the arrows of the links indicate which of these pairs is being represented)

Within Sleep: links between Sleep factors

Within Wake: links between Awake factors



When Awake factors are correlated, it means that it can be hard to tease apart which was driving any potential effect on sleep. In the example, Caffeine and Alcohol were positively correlated, and Yoga and Alcohol were oppositely correlated. Because Caffeine and Alcohol both correlated with sleep quality, to tease them apart, another week (at least) could be tracked and actively avoiding having them occur on the same days.

In this example, the sleep factors are not correlated. Specifically, neither pain nor total sleep time impacted the diary entries for sleep quality.

This view also allows discovery of potential “cycles” of correlations, which can be either positive (virtuous cycles) or negative (vicious cycles). For example, better sleep quality was linked to next-day Yoga, and Yoga was linked to less Alcohol, and Alcohol reduced sleep quality. So, we can look at Yoga as being part of a potential virtuous cycle that indirectly improves sleep quality.

GST: Step by step ... Analytics page

This page provides a slightly different view of the same data. Each panel shows the data from a single Sleep factor, divided according to days in which each Awake Factor is was either present or absent (+ or -). For Awake factors that are numbers, like caffeine, that would mean dividing into “none” versus “any”. This is a way of looking at how each sleep factor was behaving according to days grouped according to Awake factors. It is less useful for Awake factors that are never “none” or “0”.

GST: Step by step ... Taking Action!

After visualizing correlations and patterns in the Insights page, self-testing can continue by making an active intervention. Such actions can take one of two basic paths.

First, one could focus on an existing behavior from the Awake factors and modify it, then continue recording for at least another week. For example, if it turned out that caffeine or alcohol correlated with worse sleep quality, the action could be to reduce intake and see how much sleep quality improved.

Second, one could introduce a new behavior, like meditation or an herbal supplement, and seeing how all of the factors tracked in the diary react. This is also called a “before-after” comparison. The correlations could be compared, or the actual measurements could be compared (either by comparing the Analytics page results, or by exporting the data to a CSV file and using another program to analyze).