

Overview

We have prepared JB's iGraph™ for our next phase of treatment. In this module we will navigate the first 5 weeks of the new treatment phase and continue to learn about variability analysis and how the variability of the data can be incorporated into the clinical decision making process.

The Adjusted Treatment Phase

We embark on the new 1-hour session treatment plan and collect some additional data. We will enter that data and then perform some analysis to get an indication of how the new treatment plan is working.

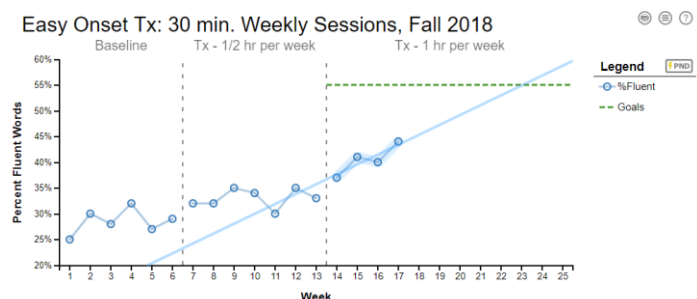
iGraph™ Practice 1.5.a

1. Add the data shown in the table below to the third phase of data markup. Be sure that you scroll to the right and add it to the same line as the rest of the markup. If you place a new line in the data markup box, then the iGraph™ won't recognize it as part of the same data series.

WEEK	PERCENT FLUENT
14	37
15	41
16	40
17	44

2. Now that we have a few weeks of data collected for the new, longer, treatment sessions, we can begin to answer the question about when we can expect JB to reach her goal of 55% fluency. As before, you can utilize the trend of the treatment data to forecast JB's performance. Click on the data path and bring up the Analysis Results panel. Next click on the trend icon to show the trend visualization on the iGraph™.

It looks like the new, longer, treatment sessions have resulted in a change in the rate of progress. JB seems to be making improvement at a much higher rate than with the 1/2-hour sessions.

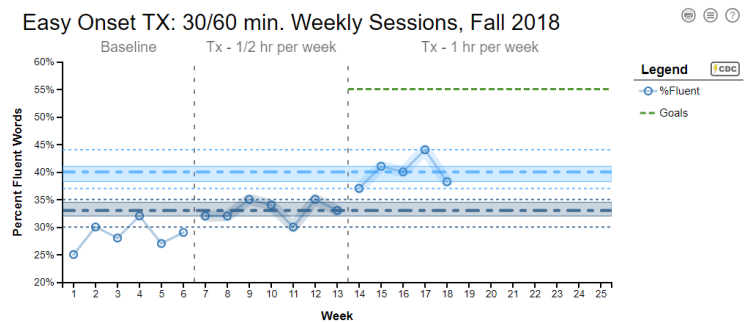


In addition, the trendline seems to show that if things keep up, it is likely that JB will come close to reaching her goal sometime around week 23 or 24!

Things are looking more optimistic. However, that forecasted performance is not guaranteed - her current trajectory could revert back to something more like what it was before. Perhaps giving her a copy of her iGraph™ could be a good reminder of how her hard work can pay off. It may just be the motivation she needs to keep up the good work so that she can attain her goal before the start of summer break.

- Let's close out the Analysis Result panel (click the close button on the top-right of the panel) and then compare the data path from the second treatment phase (the third overall phase) to that of the first treatment phase (the second overall phase). Just drag and drop the new treatment data path onto the previous treatment data path. We will start by comparing level and variability.

- Like before, click on the level icons for each of the data paths and then click on the median lines in the iGraph™ to bring up the variability visualizations. The graph should look like the one on the right.



Again, the IQR looks about the same, but unfortunately it looks like the data range has increased. Isn't that a bad thing?

- Bring up the Level details panel for the last phase and write down the details in the table below. It has been prefilled with the data from the other two phases already, so now by adding the results for the third phase we can quantitatively compare all three phases together.

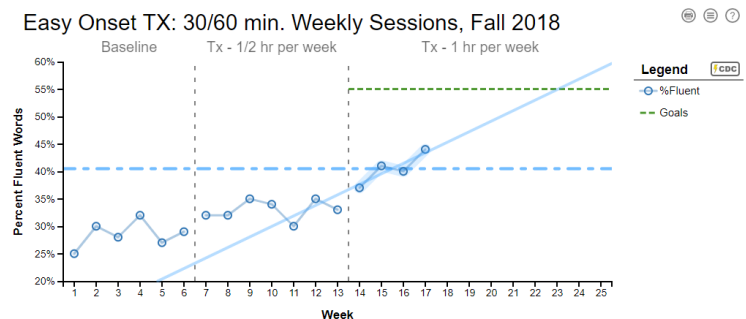
Sure enough, it looks like the range has increased to match that of the baseline (where the range is 7). Is JB losing some of the consistency that she had gained in the second phase (where the range is only 5)? Let's take moment to think about this question.

Level and variability details for the baseline and treatment phases

Metric	Baseline (from module 1.3)	Treatment Phase 1 (from module 1.3)	Treatment Phase 2
Level	28.5	33	
IQR	2.5 (q1: 27.25, q3: 29.75)	2.5 (q1: 32, q3: 34.5)	
Whiskers	7 (lower: 23.5, upper: 33.5)	5 (lower: 30, upper: 35)	
Tukey Fences	10 (lower: 23.5, upper: 33.5)	10 (lower: 28.25, upper: 38.25)	
Data Range	7 (q0: 25, q4: 32)	5 (q0: 30, q4: 35)	

It is normal to see variability around the median – human behaviour is rarely 100% consistent. As we discussed earlier, we often want to see reduced variability around the median because this suggests that our client is becoming more consistent in applying the new skill we are teaching. Sure enough, JB’s variability did reduce in the first phase of treatment – but now it’s increasing again! What’s going on?

To figure this out, we need to consider the impact of her pace of change. Think back to the trend line we saw for the first phase of treatment (the 30-minute sessions) – her pace of gains was only 0.17% per session, so the trend line wasn’t all that different from the median line. In the second phase of treatment (the 1-hour sessions), she has been improving at a much faster rate of 1.92% per session and we can see that the trend line is really quite divergent from the median line. So, how do we consider variability in the context of more rapid gains in performance?





Variability Measures that Account for Trend

As we just discussed, looking at variability around the median doesn't seem to work as well when there is a more rapid pace of change in performance - the rate of improvement overwhelms some of the basic level variability measures. In order to answer our question on if JB is becoming more consistent, we need to look at variability around the trend line rather than around the level line.

Luckily for us, iGraph™ makes it easy to perform this analysis both qualitatively and quantitatively. We're already familiar with the process since we used it to analyze the level. We'll just do something similar and look at the trend details.

iGraph™ Practice 1.5.b

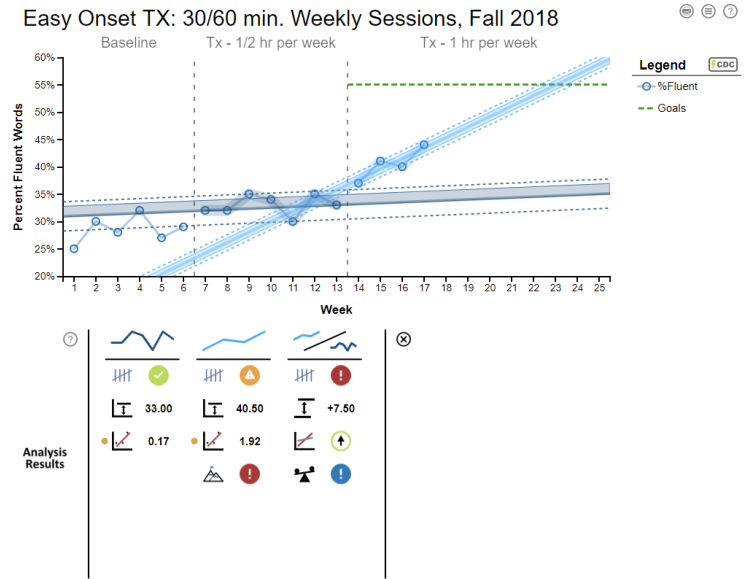
1. If you still have your graph up from the last section, simply click on the level icons  to hide the level visualizations on the iGraph™. Otherwise go back and compare the second treatment phase (the third phase overall) to the first treatment phase (the second overall phase) by dragging the data path from the second treatment phase and dropping it on the first treatment phase.

Next, click on the trend icons  for each of the data paths in the first 2 columns of the Analysis Results to show the trends for each phase of treatment. Your iGraph™ and Analysis Results Panel should look like the one shown below. You will see a little tan circle to the left of the trend icon to indicate which trend lines you are showing on the iGraph™. For now, don't worry about the information in the third column, which is the comparison column – we'll get back to this column later.

- Just like with the level lines on the graph, the trend lines also can be clicked to show a trend adjusted variability visualization.

Go ahead and click on the lines to bring up the first visualization for each of the trend lines.

Note that if you clicked on the trend icon in the third column, the variability visualization will NOT show in the graph when you click on the trend lines.



What are your initial impressions about data range and IQR now that trend has been accounted for?

- Look at the details panel for each of the trends. Like the level variability measures of IQR and data range, you can also calculate the IQR and data range around the trendline. This is done by calculating the difference between the trendline and the data values for each session. This difference is referred to as a *residual*. Therapy-Science uses the residuals to calculate the IQR, Tukey Fences, whiskers, and range so that you can get trend-corrected measures of variability for your data. You'll notice in the details panel you that those measures have the term **Residuals** in their label to help distinguish it from the variability analysis that you used when analyzing variability based on level.

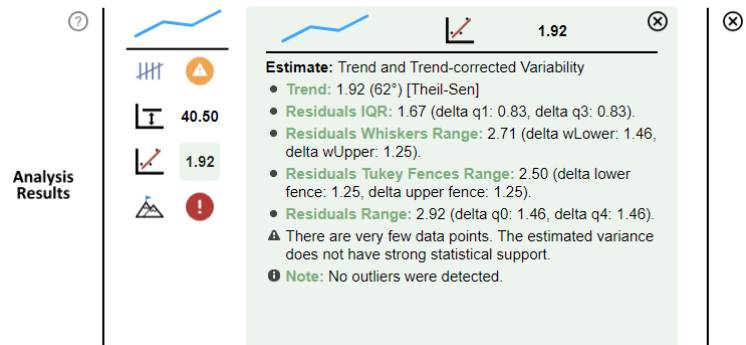
Note the **Residuals IQR** and the trend corrected **Residuals Range** in the table below for the two treatment phases of the graph. How do they compare? Would you say that JB's performance is becoming more consistent now that you have accounted for trend?




Metric	Treatment Phase 1	Treatment Phase 2
Residuals IQR		
Residuals Range		

There is a decrease in the variability from Treatment Phase 1 to Treatment Phase 2, so

answering the previous question: “Yes, the current data indicates that JB is becoming more consistent in her performance.”

- Pull up the trend details panel for the second treatment phase. Is there something of interest there? Yes, there is. Just above the note stating that no outliers were detected, there is a little warning icon that gives us some important information.



This caution is also reinforced with an orange alert icon  next to the data count analysis results icon  in the top row. Click on the  icon to see the details of the data count analysis. What does it say about the number of data points?

The message is clear; we’d best be cautious about any conclusions we draw from the data in this second treatment phase. With only 4 data points, we’re getting some good indicators that things are going well for JB, but it’s best not to overstate the situation or set strong expectations based on what we are seeing right now.

- Every individual client is a single case design. With the scarcity of data that accompanies single case designs, you will need to be sensitive to many aspects of the client’s performance. Examining all of the available analysis results will help you to gain insight that you can absorb into your clinical decision making.

Therapy-Science tries to make it easy for you to obtain detailed analytical results, but you also need be sure that you understand the relative importance of those visual and analytical results so you understand how much weight you should give them when incorporating them into your clinical decisions. Those alerts are meant to curb the temptation to see a number and take it as a precise and exact truth – it’s a sign that there is uncertainty in play, and you should accommodate accordingly.

Fractional Data Entry

The change in JB’s rate of performance improvement should have you cautiously optimistic. We begin the week 18 session with hopes that JB can achieve her goal by the end of the school

year. However, when you first greet JB, she seems annoyed and upset about something. You showed her a picture of the iGraph™ and that cheers her up a bit but she soon exhibits low energy and engagement.

It takes you much longer to get through the material you wanted to work on with her during the session, so when it comes time for the assessment to measure performance, you are rushed and she does not finish. When you go to analyze the data, you find that she was fluent on 47 of the 123 words of the story she was reading before the assessment had to get cut short.

You want to add the data from week 18 to her iGraph™. Naturally you reach for your calculator so that you can calculate the percentage represented by 47 out of 123. However, before you do, you recall that you once worked through a Therapy-Science learning module that showed you how the iGraph™ Data Markup syntax can do that math for you.

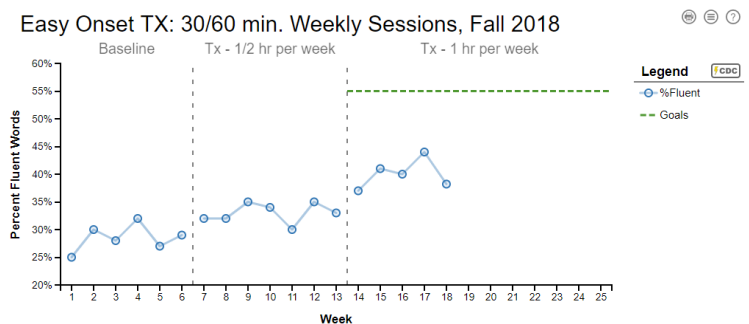
iGraph™ Practice 1.5.c

1. Instead of entering a single number for the data point, you can enter the fraction directly as 47/123. See the highlighted section of the data markup below to see how to enter that fraction.

Data Markup: ?

```
12,35,34,30,35,33 label(Tx - 1/2 hr per week) | 37,41,40,44, 47/123 label(Tx - 1 hr per week) goal(3,4,+55)
```

2. Add the new datapoint as a fraction (as shown above) to JB's iGraph™ Data Markup and then click the **Update iGraph™** button. The result should look like what is shown here.



3. This data point is somewhat troubling – an unfortunate decrease in performance. However, you add the corresponding notes to the iGraph™ Notes section to capture the peculiarity of JB's demeanor and the fact that the assessment was rushed and had to be cut short, etc. Go ahead and do that now in your iGraph™ for JB. (If you need a refresher on using Notes, we initially reviewed them in Learning Module 1.1, Practice 1.1.c – step 4.)

Detecting Outliers



It certainly looks like JB has stumbled with respect to her rate of progress. However, looked at another way, it may be that the performance of week 17 was an unusually high score and that week 18 was more in line with her actual fluency abilities. Perhaps after an initial jump in performance (just like when we started the first treatment phase) after changing the treatment to longer sessions, she is now going to plateau just like we saw before.

One question you can ask of the data is whether the week 18 performance value is “out of the ordinary” – is it an outlier?

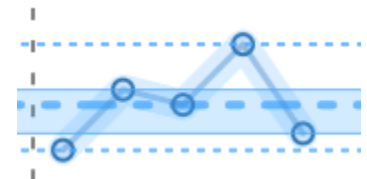
iGraph™ Practice 1.5.d

1. Let’s take a closer look at the data path and check for outliers. Click on the data path in the last phase and bring up the **Analysis Results** panel.

Looking at the data visually, it seems like it could go either way. Was week 17 an outlier (an overperformance) from a plateau? Was week 18 an outlier (an underperformance) due to something that was bothering her and the fact that the assessment was both rushed and cut short? How can we check to see if either of these scenarios is a possibility? We’ll look for outliers.



2. First, we’ll check to see has plateaued and if week 17 is an outlier to her new – possibly plateaued – level of performance. Select the level icon  to toggle the level visualization and then click on the median line in the iGraph™ to bring up the variability visualization. Does week 17 fall outside of the whiskers? Click on the number next to the level icon  to bring up the details panel. What does the level details panel say about detected outliers?

It looks like – and is confirmed by the details panel – that there are no outliers. Even if JB has plateaued, it’s likely that the measured performance on week 17 is something that she could (and probably will) be able to produce again.

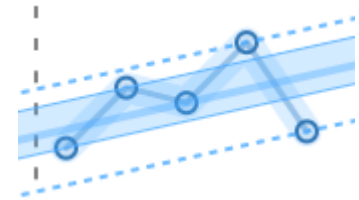


However, based on what you observed it would seem more likely that JB just had an off day during week 18. Perhaps that day was just a slight disruption in her newly increased rate of improvement.

3. Next let's assume that she really is improving at a much better rate than in the previous treatment phase. We can examine the trend and trend corrected variance to see if week 18 is an outlier based on performance that has an increasing trend.

Click on the level icon  to toggle the level visualization off. Next click on the trend icon  to show the trend visualization on the iGraph™. Then click on the trendline in the iGraph™ to show the trend corrected variance visualization. Does week 18 fall outside the whiskers? What does the trendline details panel say about the detected outliers?

As before, it both looks like and is confirmed by the details panel that week 18 is not an outlier when we consider the trend (rate of improvement). So, what do we do next?



The experience we are having with JB is a good reminder that while even with easy-to-use visual-qualitative and visual-quantitative tools at our disposal, those tools can only give us insight. We still have to learn to navigate uncertainty as we to continue to deliver the most effective possible therapy.

Ultimately, we must integrate everything we know about our client; from the insights that qualitative and quantitative analysis of the data can yield, the notes that have captured key moments from past sessions, the carefully crafted intervention plan that can be used as a guide, and an understanding of the client's attitude towards treatment as well as their desire to improve.

The only contrary information that is challenging our current intervention plan is some uncertainty around where we are headed. This is thanks to an inconvenient data point (which, due to JB's uncharacteristic behavior during the session, has a plausible cause).

So, upon some reflection there really doesn't seem to be much evidence that we need to alter our treatment. Perhaps worried about damaging her motivation, we decide that next week we will avoid showing JB her data until after we completed therapy and assessed her performance. There is no need to risk getting her discouraged by the drop in performance from week 18 until we can be more certain that it wasn't just an anomaly.

A Clinical Decision Based on Variability Analysis?

In the previous module we learned how to analyze level, trend, and variability. In this module, we added the ability to look at trend-corrected variability as well as a convenient way to enter data as a fraction for cases when we don't want to calculate the fraction and convert to a percentage, or in cases where we may want to retain the raw data as part of the markup.

After week 18, we tested the data to see if we could detect an outlier that might help us determine if JB was plateauing (and week 17 was an outlier) or if the increased rate of improvement shown in weeks 14 through 17 were real and week 18 was just an anomaly. The statistics were inconclusive, but our observations lead us to believe that week 18 was out of the norm for JB and it would be prudent to proceed as planned. And so, in the next module we will press on with our treatment plan and continue to monitor progress.

Hopefully by walking through some of the thought processes that occur when working with JB, you are able to see how to leverage some of these analysis tools – along with knowledge of your client and a familiarity with appropriate therapy methods – so that they can be incorporated into your treatment decisions.

Congratulations!

You have now explored the trend corrected variability analysis tools that are included iGraph™. You were able to see how they can be used in conjunction with the level variability analysis tools to help give you a better understanding of how your client is performing. You also learned a quick way to enter raw fractional data into the data markup that is a quick shortcut that can help to streamline your data entry process.

Below are listed a series of How-To resources that you can use to obtain more information on analyzing data series using Therapy-Science and the included iGraph™ analysis methods.

Relevant How-To Resources

Additional information on some of the technical steps covered in this tutorial are covered in the following How-To articles. You can find these in the **How-To Index** that is in the **Quick Links** section of the **Resources** page.

- How-To: Make Goals and Benchmarks
- How-To Analyze Data I: Single Data Series
- How-To Analyze Data II: Level, Trend, and Variability