

# Applying the Principles of Adult Learning to the Teaching of Psychopharmacology: Storyboarding a Presentation and the Rule of Small Multiples

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## NEW TREND IN PSYCHOPHARMACOLOGY

Medical presentations can be designed as a data dump or as a story. One effective communication strategy is to organize a lecture as a three act play, starting with previews as the first act and ending with reviews as the third act. Previews facilitate learner achievement and may help learners view a medical instructor more positively. Reviews also help consolidate audience learning and ensure that messages have been clearly delivered and received. The main act is in the middle and is the content itself. Delivering this content in small multiples gives learners manageable packets of information and can help them to see the differences and similarities between conditions, deepening their understanding of what was presented.

## INTRODUCTION

Applying principles of adult learning can enhance the effectiveness of a medical presentation. A previous "Trends in Psychopharmacology"<sup>1</sup>

presented an overview of these principles and discussed targeting the learner rather than the content or the lecturer as the focus for a medical presentation. Here we cover the concept of presenting content to a learner as a story and show how to organize or "storyboard" it as a three act play.

## STORYBOARDING A MEDICAL PRESENTATION AS A THREE ACT PLAY USING PREVIEWS AND REVIEWS

Lectures can be arranged as a dull recitation of facts or as a story that makes the facts come alive. Generally speaking, a participant is less interested in hearing the facts that a lecturer has to present than in listening to a story the lecturer has to tell.<sup>2</sup> Organizing content into a "three act play" can make a lecture memorable and its lessons practical. Classically, teachers have explained the three parts as: "Say what you are gonna say; say it; then say what you said." More specifically, the previews are the first part, the presentation itself is the second part, and the reviews are the third part of this structure.<sup>3</sup>

Adding previews and reviews is one of the easiest ways to enhance the impact of a presentation. This can be done simply by following the old saw: "Begin with the end in mind."<sup>4</sup> This

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involves previewing what the outcome of the lecture should be, then giving the lecture, and finally, emphasizing the key points and expected outcomes from the presentation with reviews.

### **Previews as the First Act**

The standard format for the first “act” of a presentation is to list the objectives of the presentation. However, it is also possible to incorporate much more powerful previews or “hooks” that can propel the participant headfirst and with eagerness into the content that is about to follow. When given previews, learners may perceive a medical instructor more positively because they see evidence of preparation.<sup>5</sup> The simplest place to start is to insert an outline slide at the beginning of the presentation. Then, have the outline recur at appropriate points throughout the deck to remind the audience of the topics ahead as well as those already discussed. The outline slide serves as a route map at the start and as a signpost at key intervals along the learning path.

Previews can include a clinical anecdote, especially one from the presenter’s own experience, that shows why the material is important or relevant. Another option is to hook the audience in three steps: issue, action, and benefit.<sup>3</sup> That is, state what the issue will be in the upcoming content, explain what action the participants should take, and finally, convince them to take this action by clearly showing the benefits. This approach of preparing an intriguing first act with previews can prime the audience for the second and main act of the storyboard, namely the content itself.

### **Reviews as the Third Act**

Reviews provide a second opportunity for learning by clarifying material for those who did not completely understand, to link cumulative presentation elements, and to help the audience members consolidate what they have learned.<sup>5</sup> Insertion of a summary or conclusion slide at the end of each section is the simplest way to address this tactic. A more elegant way is to remind the audience of the issues that were discussed, the actions that they should take, and why they should do it by emphasizing the benefits to them of this action.

### **Organizing the Main Act According to the Rule of Small Multiples**

The main part of the presentation, following the set up with a preview and a hook, is the body of the lecture itself. This content portion is the

second and longest act of the three act play. The main act must contain graphical excellence. As mentioned, if knowledge transfer rather than simple exposure to content is the goal, then it is important to optimize the visual presentation of data while avoiding overwhelming the audience with too much information all at once.

Tufte is considered the champion of how best to represent data visually. His book, *The Visual Display of Quantitative Information*,<sup>6</sup> was named one of the 100 most important books published in the Twentieth Century. Tufte is also credited with discovering why scientists did not foresee the Challenger space shuttle disaster, even though the data that predicted the failure of the famous o-rings were in plain sight of some of the smartest people in the world prior to the launch.<sup>7</sup> They missed the predictable disaster because of the wrong graphical presentation of their data. Tufte discovered that when the data on o-ring damage was sequenced by date of launch, as it was prior to the fateful launch, this obscured the possible link between temperature and o-ring damage. When the evidence was placed in order by temperature, it was obvious that o-ring damage increased as temperature decreased. This was especially significant at temperatures below 65° Fahrenheit; prior to launch temperatures were down to 52°. The scientists thus missed this relationship and approved the launch at a temperature between 26° and 29°, with catastrophic outcome. This is a powerful lesson in the importance of graphical representation of data.

Some of the principles of graphical excellence proposed by Tufte<sup>6-8</sup> are shown in Table 1. One of the central notions is the emphasis on “data ink” (ie, dots, lines, and labels; the non-erasable core of a graphic and the non-redundant ink arranged in response to variation in the numbers represented) and the de-emphasis of “non-data ink” (such as the title, the abscissa and ordinate, and their labels), while changing the data ink as the data change. Tufte cites two relevant aphorisms: “For non-data ink, less is more; for data ink, less is a bore.”<sup>6</sup>

One of the best ways to apply these principles of graphical excellence is not simply to trim the volume of content but to present the information that has been selected as “small multiples.” To do this, an instructor can look for information that can be grouped together. As each new multiple of knowledge is added, emphasis is then placed both on its difference from and its similarity to

the previous multiple. This tactic helps link the separate pieces of information.<sup>6-8</sup>

Small multiples can apply not only to data graphics, but also to text and to pictures. By far, the most elegant visual examples of how to present data as small multiples come from Tufte's books, but a few useful, if simplistic, examples of organizing a presentation's data, text, and pictures as small multiples are given below.

### Showing Data as Small Multiples

In presenting data for a lecture, PowerPoint "builds" are a good way to emphasize "data ink" because the "non-data ink" portions do not change as the data are "built." In Figure 1D, all the data are shown simultaneously. The message is implicit in the graphic and it is possible for the viewer to figure out the message eventually by searching this visual as someone explains it as issue, action, benefit.

**TABLE 1.**  
**Excellence in Graphical Displays<sup>6-8</sup>**

- Use complex ideas communicated with clarity, precision, and efficiency
- Draw the viewer's attention to the sense and substance of the data
- Show the data with a high proportion of data ink
- Emphasize data ink (such as dots, lines and labels, the nonerasable core of a graphic, and the non-redundant ink arranged in response to variation in the numbers represented)
- De-emphasize non-data ink (such as the title, the abscissa and ordinate and their labels)
- Change data ink as the data change
- Induce the viewer to think about substance rather than about methodology, graphic design, the technology of graphic production, or something else
- Avoid distorting what the data have to say
- Present many numbers in a small space
- Make large data sets coherent
- Encourage the eye to compare different pieces of data
- Reveal the data at several levels of detail, from a broad overview to the fine structure
- Serve a reasonably clear purpose: description, exploration, tabulation, or decoration
- Be closely integrated with the statistical and verbal descriptions of a data set

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### Issue

Even before the visual is shown, the message may be made explicit and more memorable by the presenter stating out loud that the upcoming issue is how long to wait for remission after treatment of anxiety with a drug.

### Action

The action that will be proposed, to be taken if the participant is convinced by the data, is to wait longer before giving up on patients with severe anxiety than with patients with moderate anxiety. The reasoning for this action is that much of the remission of moderately anxious patients occurs before 6–8 weeks of treatment, whereas much of the remission of severely anxious patients occurs after that time.

### Benefit

Finally, the presenter can mention in advance of showing the slide what the benefit will be to the participant of understanding the issue and taking the action, namely that more patients could experience remission, especially the severely anxious ones, if treatment is extended past 6–12 weeks.

This graphic can serve to enhance learning and integrate the new information into clinical practice. It does show that, for patients with severe anxiety, it may be beneficial to consider not switching or stopping this drug before most of the patients are likely to remit, even though that may mean waiting for a long time (>4 months) for some of them to remit. These words can all be used by the presenter to describe the fully-built slide (Figure 1D).

However, the data can also be woven into a less complex and possibly more compelling story of small multiples. First the placebo remission rates for moderately anxious patients over time (Figure 1A) can be shown, then the drug remission rates for moderately anxious patients over the same time (Figure 1B) can be presented, proving that the drug works better than placebo for moderately anxious patients and that much of the remission has occurred by 6–12 weeks. Tufte would call this showing the "non-data ink" before showing the "data ink." Since the non-data ink would not change across all four builds, all the eye would see is the new information, including its relationship to the information already presented.

Thus, as the presenter clicks through these four builds, the presenter is exploiting an involuntary visual reflex. Anyone who has seen the data ink in Figure 1B has accommodated to it, and when the

placebo group for the severely anxious patients is added (Figure 1C), this causes the viewer to see immediately and almost involuntarily how these data relate to the placebo response of the moderately anxious group. It is obvious now that this rate is lower for the severe group. There is no need for a laser pointer here. Also, if a computer screen is in front of the presenter, there is no need for the presenter to turn towards the screen and lose eye contact with the audience.

The coup de grace is the major point to be made, revealing drug remission rates for severely anxious patients (Figure 1D). The data for this finale show that, in contrast to moderately ill patients, many of the severely ill patients respond AFTER 6–12 weeks (Figure 1D).

Although this approach can be a powerful learning tool and behavioral motivator, it does create problems for the presenter. First, it takes extra time to program the builds. More importantly, however, is that the speaker has to anticipate and set up each forthcoming slide build in advance of showing it. Most presenters use slides as speaker notes, which does not work for data building. Clicking to the end through Figures 1A through 1D and then starting to speak has the same impact as putting the punch line of a joke on the slide before starting to tell the joke. In order for this building of data as small multiples to have the maximum impact, the speaker will want to be familiar with the slide as well as with the data, have the motivation to show the data by telling a story, and be willing to rehearse the presentation.

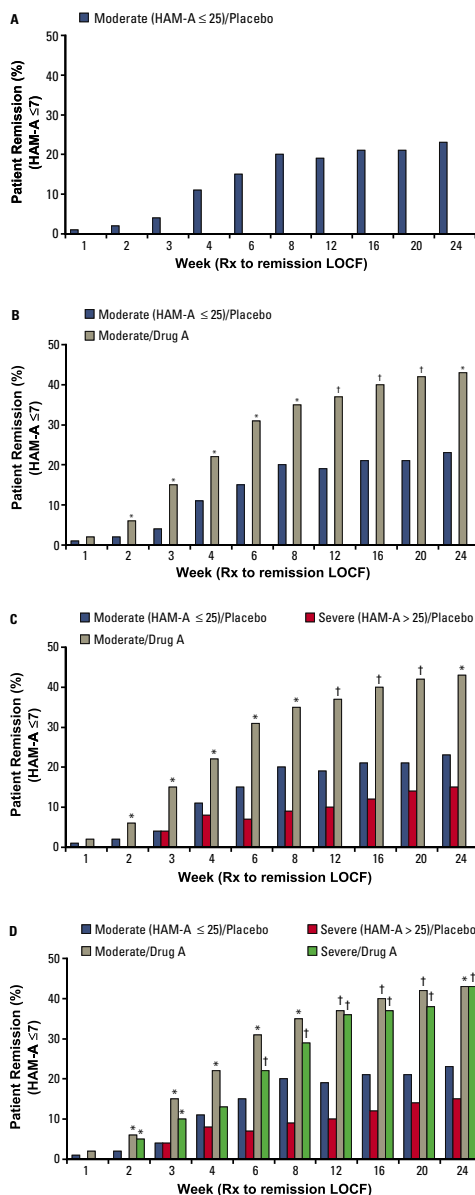
### Showing Text as Small Multiples

Using small multiples of text allows the medical instructor to modulate the speed of learning. As in graphic presentations of data, animations of portions of text can be used to make each multiple appear as the medical instructor speaks to that specific topic. In this way, learners move ahead with the instructor and are not distracted by coming information.

In text, presenting bullet points in parallel structure can help emphasize small multiples. To achieve parallel structure, the instructor can start each bullet with the same type of word: all verbs, all nouns, etc. Parallel structure is the way to separate “data ink” from “non-data ink” in a text slide (Table 2). That is, the non-data ink is the structure of the words. If there is a parallel structure, there is no new structure to figure out with each new line of text, and the form of the words becomes non-data ink. That

freees the reader to “see” only what is novel with each new bullet point, namely the substance of the new information, ie, the data ink. By the time there is a third bullet point, the pattern is established and it is progressively easier to get to the substance of subsequently developing text. The characteristics of presentations using well-designed small multiples are summarized in Table 3.

**FIGURE 1.**  
**Onset of Action of Drug B in GAD**



GAD=generalized anxiety disorder; HAM-A=Hamilton Rating Scale for Anxiety; Rx=prescription; LOCF=last observation carried forward.

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**Showing Figures as Small Multiples**

Since small multiples resemble the frames of a movie, it is relatively easy to deconstruct the figure of a dynamic biological process into its “stop action” components as the process proceeds from beginning to end. Flash animations can do this continuously and smoothly but are even more time consuming to develop than PowerPoint builds. If successful, this PowerPoint display tactic will draw attention entirely to shifts in the data and thus to what is happening next in a sequence of actions. This tactic also exploits the same involuntary visual reflex as discussed above for data graphics. The eye will go to the new or changed elements—those appearing, disappearing, or moving. The eye will also see the relationship of these elements to the “non-data ink” components that came before.

An example of this is shown in Figure 2. One way to build this is to show everything on the same slide, as illustrated in Figures 2A through 2E. Another is to superimpose the images upon

each other sequentially, as shown in Figures 2F through 2K. The advantage of the first tactic is that it is easier to review the entire build that has been shown. The advantage of the second tactic is that there is less “non-data ink” and thus more emphasis on what is changing dynamically as well as the relationship of these changes to what has come before in the sequence. Either tactic is acceptable and either is better than a complex slide with no builds.

The point of Figure 2 is to show that the amygdala processes the emotion of fear and that the more fear processing there is, the more prone one is to anxiety. Furthermore, there is one genotype of the serotonin transporter that creates greater reactivity of emotional processing in the amygdala than another and thus carries a greater risk of an anxiety disorder than another. All this can be said in a complex, complete version of the slide (Figure 2E). However, the story can be developed by first showing the “non-data ink” with the title, the subtitles, and two identical brains with no activity. One of these brains is in a person with the first genotype and the other is in a person with the second genotype (Figure 2A). When one builds the provocation of fear by showing a scary face while the subject is in the brain scanner (Figure 2B), then one can set up the low activation of the amygdala in those with the first genotype (Figure 2C). It can be shown that this does not work when fear is provoked in subjects with the second genotype (Figure 2D), who respond with a high degree of amygdala activation (Figure 2E). Alternatively, these images can be shown on top of each other (Figures 2F through 2K).

**TABLE 2.**  
**Parallel Structure in Bullet Points**

<i>Before</i>	
	Drug A: PROS • Can be used off label for dementia with aggressive features • Has been studied in children with various behavioral disturbances • Long-acting form available that is useful for noncompliant patients • Becoming generic soon and will be inexpensive
<i>Sort by</i>	<i>After</i>
Verbs	Benefits of Drug A • Treats dementia with aggressive features (off label) • Treats various behavioral disturbances in children (off label except autism) • Treats noncompliant patients (long-acting formulation) • Costs less than similar drugs (with generic soon available)
Direct objects	Drug A is useful for treating • Dementia with aggressive features • Children with various behavioral disturbances • Noncompliant patients (long-acting form) • Financially restricted patients
Patient type and drug characteristics	Drug A treats • Dementia with aggressive features • Children with various behavioral disturbances • At low cost • In a long-acting formulation

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**TABLE 3.**  
**Review of the Characteristics of Presentations Using Well-Designed Small Multiples<sup>6</sup>**

- Inevitably comparable multiples
- Deftly multivariate
- Shrunk, high density graphics
- Usually based on a large data matrix
- Drawn almost entirely with data ink
- Efficient in interpretation
- Often narrative in content, showing shifts in the relationship between variables as the index variable changes (thereby revealing interactions or multiplicative effects)

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**FIGURE 2.**  
**Parceling out image slides into small multiples**



Figures 2E, 2H, and 2K presents all of the information at once, which may be overwhelming and therefore have low impact. Alternatively, the parceling out allows the instructor to use PowerPoint builds to bring information in slowly Figures 2A through 2E; Figures 2F through 2H; and Figures 2J through 2K.

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## CONCLUSION

Applying the principles of adult learning to the design of a medical presentation suggests that learning can be enhanced by organizing the data in a manner that is learner-focused. Thus, telling a story rather than dumping data is the key, and this can be done in a number of ways, including as a three act play, starting with a first act that previews, a main act that has the content, and a third act that reviews. The main act can itself be organized according to the rule of small multiples in order to present the data and the content as an evolving story with a conclusion, leading to remembering the important points and to transferring this learning into clinical practice. **CNS**

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