

Better Ways to Present Information and Data

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Introduction

In this age of Web2.0, we are at an all-time high of ready-access information and overload. A study by Martin Hilbert and colleagues in 2011 showed that we take in the equivalent of 174 newspapers worth of information daily. Compare that number to “only” 40 newspaper’s worth taken-in daily in 1984 and you soon start to see how information overload is only going to increase over time. This is especially important to consider for healthcare professionals as they seek to find the most relevant information or CME content to support their lifelong learning goals and address their self-identified needs.

To make our content stand out from everything else that is vying for their attention, it is imperative that we differentiate our information with thoughtfully designed, visual elements that are quick and easy to understand.

Combining data with effective design to facilitate visual consumption is an effective way to ensure our content is more quickly and easily understood. In fact, fifty percent of the human brain is dedicated to visual functions. Images are processed faster than text (Merieb and Hoehn 2007). Because visual literacy precedes verbal literacy in human development, it is the basis of thought processes that are the foundations for reading and writing (Berger 1972).

There are practical implications to this neuroscience. For example, Turck et al (2014) studied health-care professionals’ preference for infographic versus conventional, text-based abstracts for communicating results of clinical research. The researchers found that clinicians preferred infographic abstracts to text for a quicker, more efficient read, and that the infographics more likely facilitated long-term factual retention.

The

4

Step

Plan

to Presenting Information with Impact

In cognitive psychology, **cognitive load** refers to the total amount of mental effort being used in the working memory. Cognitive load theory, developed by Sweller in the late 1980s, (Sweller 1994) differentiates cognitive load into three types: intrinsic, extraneous, and germane. Intrinsic load is defined as the inherent level of difficulty in any given topic, germane load fosters learning, and extraneous load impedes learning.



This framework led us to develop a simple and practical approach to designing information with impact. At the heart of it, our process aims to reduce extraneous cognitive load and increase the germane load of information and education.

Our 4-step process can be applied to any form of information including medical education slides, internal communication reports, outcomes reports and more. Using this stepwise approach and examples outlined, you will have the tools you need be able to apply this process in your own materials, having completed the case study below.

1



Cut and Categorize

2



Define Messages

3



Determine Visuals

4



Apply Style



Step 1: Cut and Categorize

The first step of the process begins with minimizing any unnecessary mental work on the reader. By removing excessive complexity, you will remove some of the extraneous cognitive load. Mayer and Moreno (2003) call this approach weeding. It involves eliminating all extraneous content that embellishes the learning, even when it is interesting in its own right. The goal is to avoid promoting incidental processing that is not relevant to the learning task.

Consider words that are redundant and can be removed. How much text do you need to relay the point you are trying to make? Prune your information down to succinct bullets. In the process of condensing the information, it will become easier to pull out and assign any applicable categories within it.

Most information can be organized in such a way as to help readers quickly align with the content and help them find relevant material faster. Additionally, this step makes similarities and differences among categories of content more explicit (Clarke 2010). When categorizing your information, look for meaningful sections or repeating patterns.

An example of categorizing information is shown on the right.

Categorize information to help readers quickly align with content

Before

This was a safety and tolerability study to identify the maximum tolerated dose in subjects with advanced solid tumors. 100 mg, 200 mg, and 300 mg doses, twice daily were evaluated. Tumors were assessed by the RANO and RECIST criteria.

After

Key Objectives

- 1. Safety and tolerability
- 2. Maximum tolerated dose

Study Population

Subjects with advanced solid tumors

Treatment

100 mg, 200mg, and 300 mg doses twice daily

Assessment

Tumors assessed by RANO and RECIST criteria.



Step 2: Define Messages

A message is the one main point you want your reader to take away from each section. Work with a rule of 1 message per section or slide. By applying this rule, you will keep your reader focused only on the main key takeaway for each section. Once you have defined a message, create a “message title” for that section.

Clear and succinct message (or sentence) titles have been shown to be more effective than passive phrase titles in conveying technical information (Alley and Neeley, 2005) and aiding retention (Alley et al 2006) in various audiences.

Examples of passive phrase titles versus message titles are shown below.

Message titles focus the reader on the key messages for each section.

Passive Titles

Phase I Study Design

Multiple Sclerosis CME Activity: Audience

Message Titles

vs

vs

The Phase I Study Was a Single-Arm, Dose-Escalation Design

The Multiple Sclerosis Education Reached the Appropriate Audience



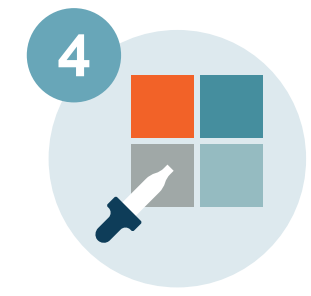
Step 3: Determine Visuals

Multiple studies (Verdi et al 1997, Patton 1991) over many years have pointed to the effectiveness of the use of visuals in learning and retention. Of note, the use of illustrations or graphics presented together with short pieces of text are found to be most effective in learning. In the third step of our process we consider which types of visuals are optimal in the delivery of our information. Visuals should aid, and not deter from the information being presented. Specifically, if you were to remove any text accompanying the visual, the reader should still be able to get a sense of the information being conveyed.

Consider the complexity of your visuals. How complex is your visual and can you simplify it? Butcher (2006) compared the understanding of heart circulation presented in three formats: text, text plus simple line drawing, or text plus a more accurate 3-dimensional (3D) drawing. Both visual formats led to more learning than text alone. However, the simpler line drawing was more effective than the 3D version.

When determining the use of visuals in designing your information, consider the following types:

Logos aid recognition of key groups 	Maps convey geographical data 	Icons align readers to different categories
Charts convey numerical data 	Timelines convey temporal data 	Schematics convey process information



Step 4: Apply Style

The goal of this step is to remove any remaining extraneous load within your information.

Using inconsistent fonts, sizes, and image types all increase distraction and “noise.” Your reader sub-consciously tries to assign a relevance to these inconsistencies, thereby contributing to extraneous load. The key to successfully applied style is consistency.

In addition to using a consistent style, special consideration should be paid to your color palette. Kleinman and Dwyer (1999) found that the use of color graphics in instructional modules as opposed to black and white graphics promoted achievement, particularly when educating on concepts. Consider a specific color to highlight main points and assign colors consistently throughout.

Some style considerations are outlined below.

Fonts: Sans serif fonts are easier to read quickly Before Sans serif fonts are easier to read quickly After Sans serif fonts are easier to read quickly	Colors: Specific colors can be used for emphasis Before After 	Images: Consistent image style reduces distraction Before After
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Conclusion:

By applying this 4-step process to your content, you will be able to improve legibility, decrease the time needed to convey your information clearly, and ultimately have greater impact on the reader.

A Worked Case Study

An example of how to apply the 4-step process.

Adverse Events

Throat irritation was observed in equal degrees in the XYZ treatment group (n=46, 24%) and the placebo group (n=47, 24%) while a decreased heart rate <50 bpm was seen in 10 participants (5%) in the XYZ group and 8 participants in the placebo group (4%). Increased blood pressure was noted in the XYZ group (n=23, 12%) as well as the placebo group (n=19, 10%). Stomatitis was seen in 50 participants (26%) in the XYZ group and in 42 participants in the placebo group (22%). Constipation is the most common adverse event reported after XYZ treatment initiation (n=106, 55%) vs placebo (n=12, 6%). However, the majority of constipation adverse events for XYZ were reported in Days 1-2. Only 1% of constipation adverse events for XYZ were reported on Days 3-7. X receptors in the gut bind to XYZ and causes constipation. Upon initial XYZ binding (Days 1-2) the X receptors are internalized reducing further constipation.

Step 1: Cut and Categorize

We cut down much of the verbiage in the paragraph above, created bullets, and categorized each of the adverse events into body areas.

Adverse Events

Mouth and Throat

- Throat irritation: XYZ n=46 (24%) placebo n=47 (24%)
- Stomatitis: XYZ n=50 (26%) placebo n=42 (22%)

Cardiovascular

- HR < 50 bpm: XYZ n=10 (5%) placebo n=8 (4%)
- Increased BP: XYZ n=23 (12%) placebo n=19 (10%)

Gastrointestinal

- Constipation: XYZ n=106 (55%) placebo n=12 (6%)
- Majority AEs on days 1-2, only 1% new AEs reported on days 3-7
- X receptors in gut bind to XYZ causing constipation
- X receptors are internalized after Day 3

Step 2: Define Messages

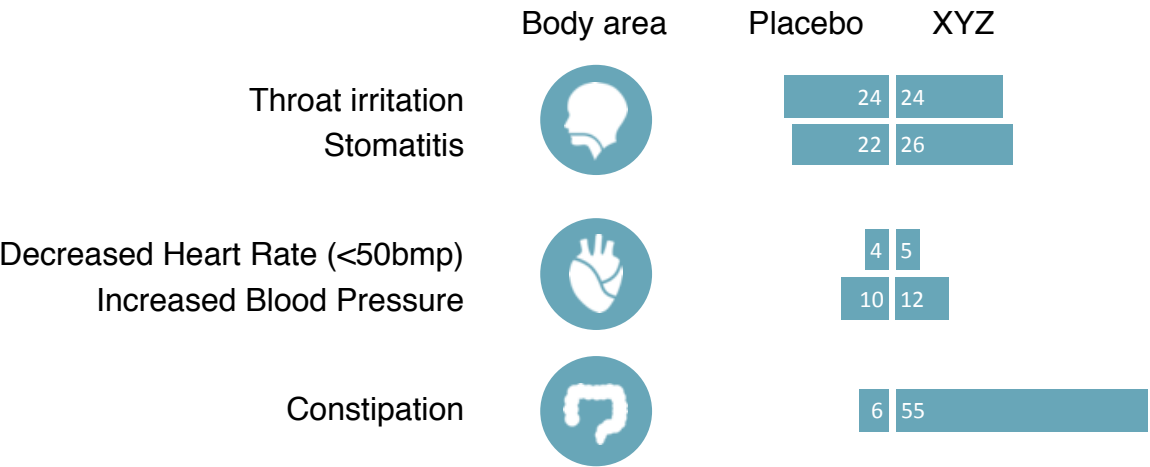
After categorizing the content, we determined that there were in fact 2 discreet messages evident in the original information and therefore created 2 message titles.

Part A: Constipation is the Most Commonly Reported Adverse Event for XYZ but Decreases After 48hrs

Part B: Constipation Decreases after 48hrs of Treatment Due to Internalization of X Receptors

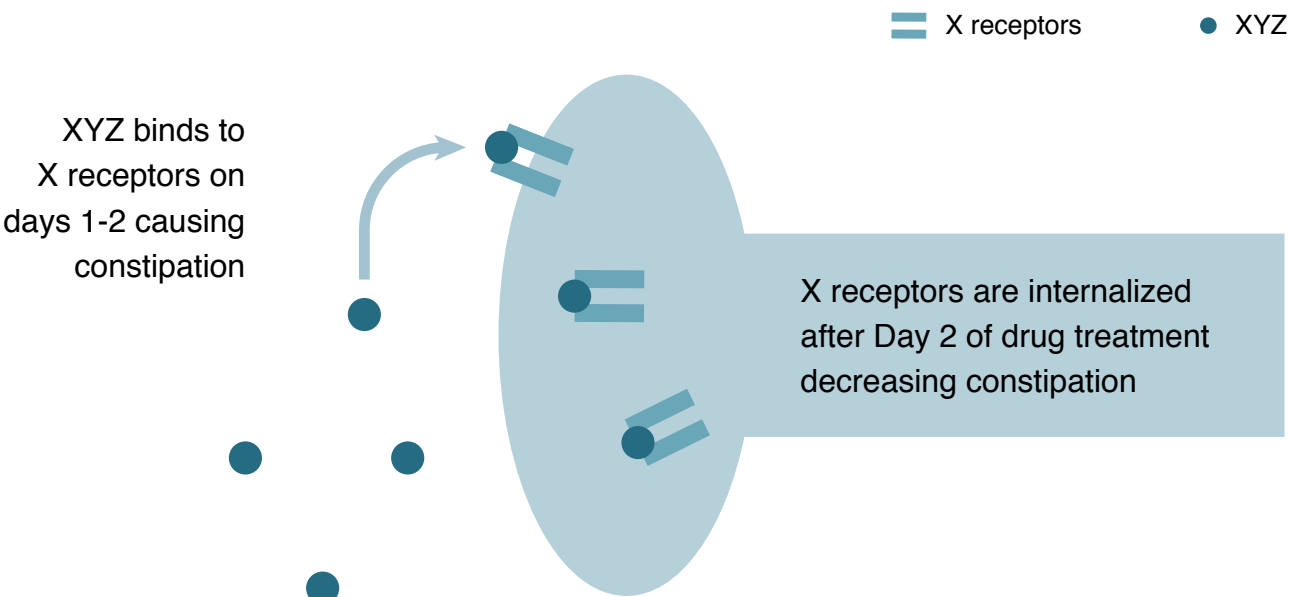
Step 3: Determine Visuals

We decided to use icons to quickly convey each AE body area category. For the AE data we used a “reflected” bar chart that effectively highlights the differences between the 2 data groups.



Step 3: Determine Visuals (continued)

For Part B we decided to use an image to show the process of receptor internalization.



Step 4: Apply Style

In the final step, in Part A, we used different colors for each body area, and orange to emphasize the adverse event of constipation, delineating it from the other AEs.

The image used in Part B shows a temporal sequence of events. To further clarify this sequence, we decided to break up the image into 3 “small multiples” showing the events taking place at each time-point.

The “before” in comparison to the transformed “after” examples are shown to the right.

Before

Adverse Events

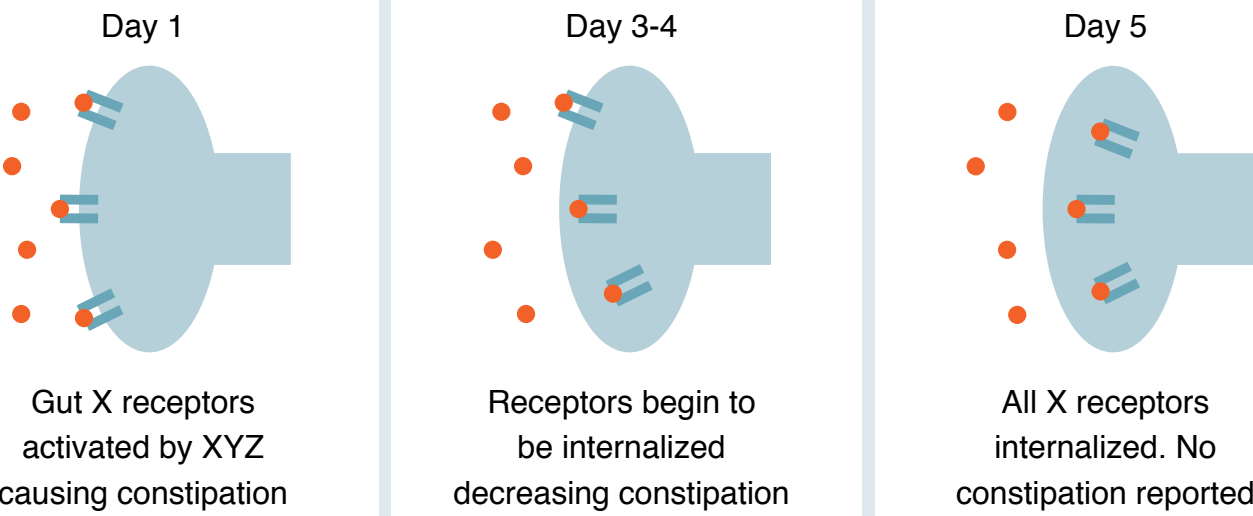
Throat irritation was observed in equal degrees in the XYZ treatment group (n=46, 24%) and the placebo group (n=47, 24%) while a decreased heart rate <50 bpm was seen in 10 participants (5%) in the XYZ group and 8 participants in the placebo group (4%). Increased blood pressure was noted in the XYZ group (n=23, 12%) as well as the placebo group (n=19, 10%). Stomatitis was seen in 50 participants (26%) in the XYZ group and in 42 participants in the placebo group (22%). Constipation is the most common adverse event reported after XYZ treatment initiation (n=106, 55%) vs placebo (n=12, 6%). However, the majority of constipation adverse events for XYZ were reported in Days 1-2. Only 1% of constipation adverse events for XYZ were reported on Days 3-7. X receptors in the gut bind to XYZ and causes constipation. Upon initial XYZ binding (Days 1-2) the X receptors are internalized reducing further constipation.

After

Part A: Constipation is the Most Commonly Reported Adverse Event for XYZ but Decreases After 48hrs

	Body area	Placebo	XYZ
Throat irritation Stomatitis		24	24
		22	26
Decreased Heart Rate (<50bpm) Increased Blood Pressure		4	5
		10	12
Constipation		6	55

Part B: Constipation Decreases after 48hrs of Treatment Due to Internalization of X Receptors



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