The Institute for Perception

Newsletter

FALL 2023 • Issue 26 (3)

IN THIS ISSUE

Striving for the perfectly balanced rotation…(pgs. 5-6)

The Institute for Perception

7629 Hull Street Road • Richmond, VA 23235

Summer 2023 • Issue 26(3)

Page #

Technical Reports

2023

26(3) Optimal Rotations to Balance Sequential Effects

26(2) Thurstonian Scaling of Preference Ranking

26(1) Odor and Taste Elimination

2022

25(4) Sample Selection for Method Comparisons

25(3) Context Effects in Surveys of Subjective Experience

25(2) Drivers of Liking® with Incomplete Block Designs

25(1) Paradoxes in Sensory and Consumer Science

2021

24(3) Optimal Rotations for Incomplete Designs

24(2) *Compared to What?* Controls in Advertising Claims Substantiation

24(1) Generating Optimal Sample Presentation Orders

2020

23(4) Unfolding Financial Markets

The Institute for Perception, founded in 1992, is a full-service research consulting firm offering comprehensive client services to assist in the development process of new and improved products and marketing concepts.

The Institute for Perception

President's Message

From Invention to Innovation

Since the industrial revolution and the Watt-Bolton steam engine to the present day, some things have not changed with respect to the requirements for the transition between a technical or marketing insight and a successful implementation of it in an innovation. Whether we consider Nike's waffle trainer, Miller Lite®, or Cheetos®, there has always been a need for an identified consumer-perceived benefit. What has changed, and continues to evolve, is how companies assess the variables involved in developing and predicting the success of new products. We will discuss the inputs needed in our Fall course program and explain a blueprint focused on the most applicable variables using tools that are designed to assess those variables.

Our technical report in this issue is on new research on sequence effects in rotations used in sensory and consumer research, market research and clinical trials. Sequence effects can impact study accuracy and precision and can undermine the conclusions drawn from research and its costs. We provide an alternative to replicated Williams Squares designs, which are often used for sequential tests.

To learn more about these and other important topics, please consider joining us in person or virtually this November at The Greenbrier, White Sulphur Springs, WV for our Fall courses entitled "From Invention to Innovation: The Roles of Sensory and Marketing Science, Machine Learning and Advanced analytics." More details are given on pages 2-4 and 7 of this newsletter.

Best Regards,

Daniel M. Ennis

President, The Institute for Perception

WHAT WE DO:

- **Client Services:** Provide full-service product and concept testing for product development, market research, and claims support
- **Education:** Conduct internal training, external courses, and online webinars on product testing, advanced analytics, and advertising claims support
- **IFPrograms®:** License proprietary software to provide access to new modeling tools
- **Research:** Conduct and publish basic research on human perception in the areas of methodology, measurement, modeling, and prediction

EVENT CALENDAR:

WEBINAR

SEPTEMBER 21, 2023……..... Thursday at 2:00 PM ET, 75 minutes
Thurstonian Models Part 2: Drivers of Liking

FALL COURSES

NOVEMBER 7-10, 2023……The Greenbrier, White Sulphur Springs, and live streamed
From Invention to Innovation: The Roles of Sensory and Marketing Science, Machine Learning, and Advanced Analytics

Detailed information and registration for all courses and webinars are available at www.ifpress.com.

To Contact Us... mail@ifpress.com 804-675-2980 www.ifpress.com

7629 Hull Street Road • Richmond, VA 23235

FALL COURSES: Tuesday, November 7 to Friday, November 10, 2023

The Greenbrier, White Sulphur Springs, WV

From Invention to Innovation

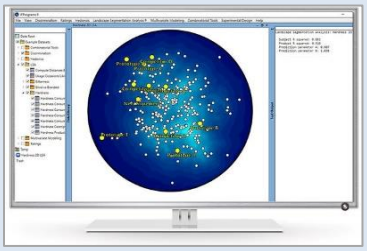
Technical Change (Course 1): Identifying Consumer-Perceived Benefits (Nov. 7-8)
Product Development (Course 2): Drivers of Liking® and Computer-Aided Design (Nov. 9-10)

All highly successful new product introductions, that stand the test of time, have certain features that drive their success. A central element is that they provide a new consumer-perceived benefit and, once that benefit has been identified, it is skillfully expressed in a new product. New product success is enhanced if the benefit is novel and enters a weakly competitive or non-competitive market. The distinction between invention and innovation is central to staffing for new product success and in recognizing the dual roles of the inventor and innovator. It is also important that the technical insight and marketing insight staffs recognize that the tools they use should contribute cooperatively to different aspects of a common goal.

We will discuss this very broad topic over the coming year in two course programs, one in the Fall of 2023 and the other in the Spring of 2024. Both programs will have two courses.

- The first program will be presented November 7-10, 2023, and will start with a 2-day course on how to identify consumer-perceived benefits from a technical change. Methods to determine whether a consumer relevant sensory difference occurs will be explored. The second course (1.5 days) will cover Drivers of Liking® methodologies leading to the optimal specifications for a new product.
- In the second course program in the Spring, we will cover marketing insights issues.

The topics for the two courses in the Fall of 2023 are given on the next two pages. Registration information is on page 7.



IFPrograms®

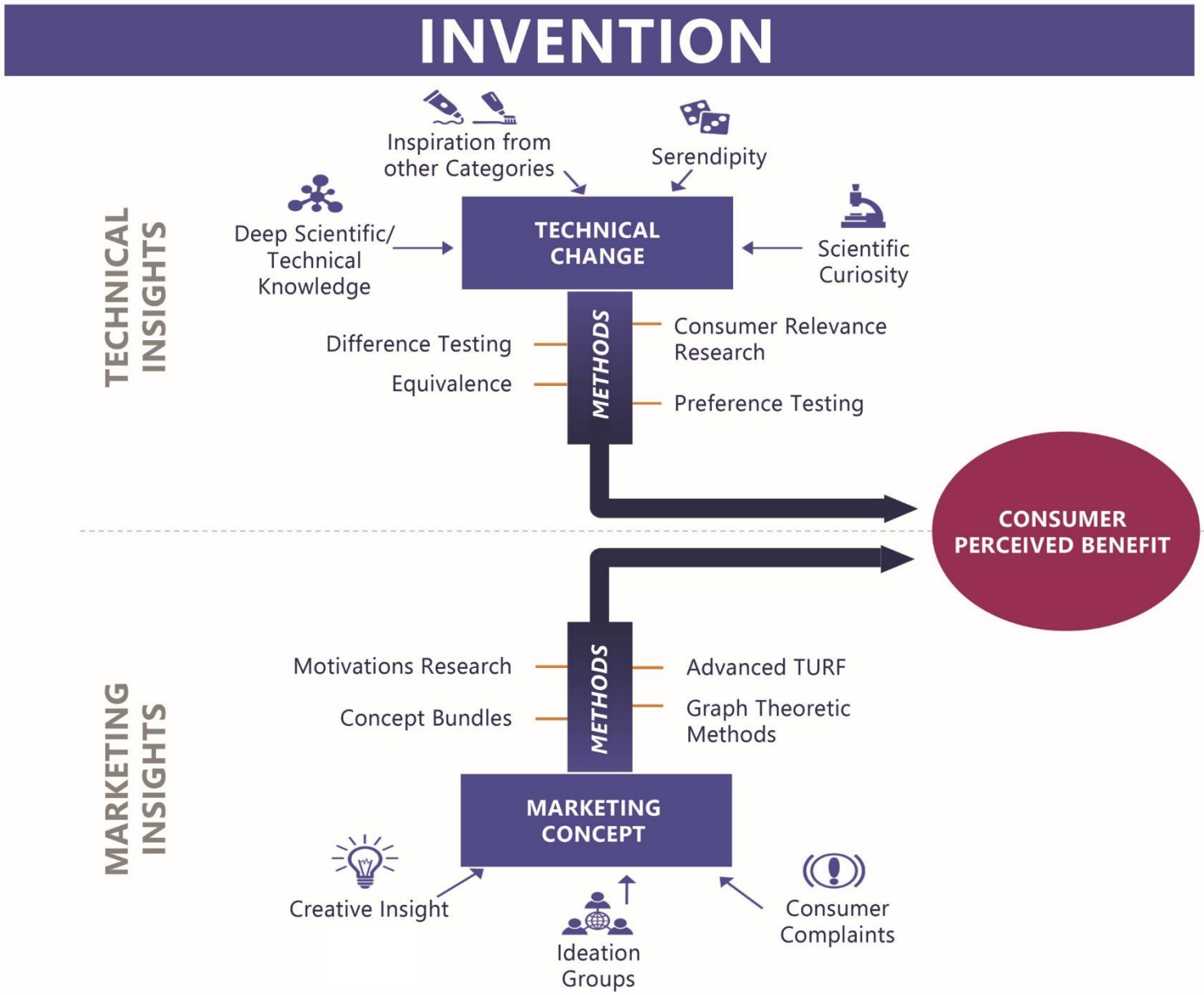
The course instruction includes software to perform analyses and exercises. Prior to the course, you will be sent information by email to install IFPrograms. To introduce you to the capabilities of IFPrograms, you will receive a complimentary 3-month trial of the Professional version used for LSA and other sensory and consumer data related analyses. For a detailed listing of IFPrograms features and licensing, please visit www.ifpress.com/software.
(Note: IFPrograms is not required to apply course principles.)

Intended Audience

This course will be of interest to a broad audience of people in any organization where success depends on introducing new products or services that are superior to their competitors or their own current offerings. This audience includes senior managers who have overall responsibility for new product brands or even new ways of working in their organizations. The course should also appeal to those in technical and marketing insights who use a variety of tools to facilitate the process of creating successful new products with appropriate branding.

From Inventio

The Roles of Sensory and Marketing Scienc



Tuesday, November 7
8:00AM – 4:00PM (ET)

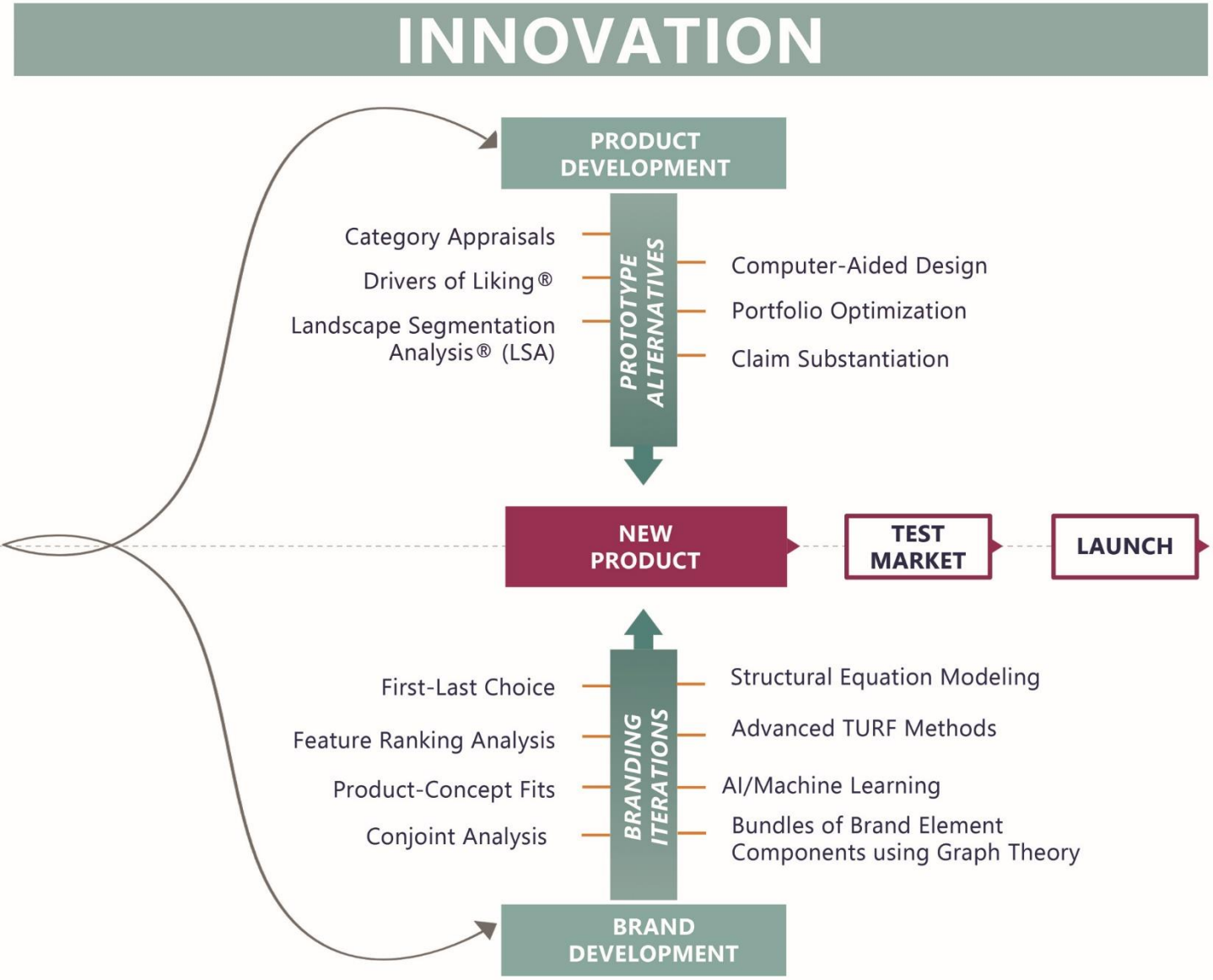
- The Invention-Innovation Paradigm
- Consumer-perceived benefits
- Innovation in the beer industry: Historical perspectives
- Olfactory innovations: The rise of the botanicals
- Testing if a technical change can be detected
- The science underlying discrimination testing
- Difference testing methods: Selecting the best option

Wednesday, November 8
8:00AM – 4:00PM (ET)

- Power and sample sizes for difference testing methods
- Linking internal panel and consumer sensitivities
- Consumer-relevant action standards: how to create them
- Same-different vs. paired preference for consumer relevance
- Risk profiles for testing power and panel sample sizes
- Equivalence testing
- Building a successful internal sensory program to identify consumer-perceived benefits

n to Innovation

ce, Machine Learning and Advanced Analytics



Thursday, November 9
8:00AM – 4:00PM (ET)

- Linking consumer response to sensory drivers
- The sensory space vs the Drivers of Liking® space
- How to plan a category appraisal
  - Product selection using graph theory
  - Method comparison to generate sample presentation orders
  - Multiple day effect, complete vs. incomplete block designs
- Factor analysis and its limitations
- Landscape Segmentation Analysis® (LSA)

Friday, November 10
8:00AM – 12:00PM (ET)

- Product development assessment tools
  - Creating the product and consumer ideal point space
  - Studying consumer segmentation
  - Sensory/analytical information to uncover the drivers of liking
  - Predicting future product performance based on computer-aided design
- LSA vs. Internal and External Preference Mapping
- Product portfolio optimization and optimal sensory profiles

2023 Issue 26 (3)

Optimal Rotations to Balance Sequential Effects

Will Russ, Kevin Yang and Daniel Ennis

Background: In previous technical reports[1] we discussed methods for developing improved rotations for sequential testing to remove bias and lower testing variances. The benefit of doing this is to obtain more accurate information and to create more powerful tests with the opportunity to lower testing cost. For most designs, the use of the Column Randomization and Search (CRAS)[1] method has proven to be useful for many designs including complete block, incomplete block, and testing with sequences containing interruptions, such as testing over several days. This method searches for position, sequences and the location of sequences in the design (called sequence spread) that are not often accounted for in the experimental design of product tests, other types of surveys and clinical trials. When they are considered, it is common to use Williams Squares[2] to control for position and sequences but not sequence spread. For instance, if the sequence (1 2) occurs at the beginning and end of a Williams Square with multiple products, this sequence will never occur at the middle of the test and replication will perpetuate this condition. This could be important because performance from the beginning to the end of a series of evaluations changes and could be different for the sequences as well as the products themselves. These designs are replicated when the number of rotations needed exceeds the size of the design. It is possible to overcome this limitation of replicated Williams Squares so that designs based on them can handle sequence spread. The purpose of this technical report is to explore this possibility.

A Replicated Williams Square with Five Products: Table 1 shows an example of a Williams Design with 5 products labeled 1 to 5. There are ${}^{5}C_{2}$ combinations of pairs of products and twice that number, or 20, if forward and reverse orders are considered. Table 1 shows that there are 10 rows because of the need to meet the requirement that the 5 positions and 20 sequences are accounted for at least once. In this case they each appear twice. But notice in Table 2 that the sequences, e.g. (1 2) are not spread equally across the design.

Scenario: You are a data scientist working in a company that markets air-care products to homeowners. Sequential effects in the evaluation of fragrances often arise and you would like to minimize bias and improve precision in central location tests. Some of your suppliers simply randomize the presentation order and you are aware that this practice does not account for position or sequence effects properly. Lately you have considered using Williams Square designs. These designs are set up so that each product appears an equal number of times in each position. They also ensure that there is balance in the frequency with which the sequences occur but not their occurrence in the rotations. To improve this condition it would be necessary, when replicating the design, to consider making sequence selections with the intent of ensuring a balance in the sequence spread.

1	2	5	3	4
2	3	1	4	5
3	4	2	5	1
4	5	3	1	2
5	1	4	2	3
4	3	5	2	1
5	4	1	3	2
1	5	2	4	3
2	1	3	5	4
3	2	4	1	5

Table 1. A Williams square with 5 products and 10 rotations. Each pair and its reverse appears twice in the design and each product appears an equal number of times in each position. However, the occurrence of sequences in the design is not uniform as shown for the sequence (1 2).

Balancing Sequence Spread: Table 2 shows the frequency of occurrence of sequences across the design of Table 1 and Figure 1 is a visual guide to Table 2. Notice that the frequency of occurrence of sequences in particular locations form a definite pattern. A design with 10 rotations appended to one that is the complement of the pattern in Figure 1 would solve the sequence spread limitation for this design.

	Item Sequence Spread			
Item Sequence	1-2	2-3	3-4	4-5
(1 2)	1	0	0	1
(1 3)	0	1	1	0
(1 4)	0	1	1	0
(1 5)	1	0	0	1
(2 1)	1	0	0	1
(2 3)	1	0	0	1
(2 4)	0	1	1	0
(2 5)	0	1	1	0
(3 1)	0	1	1	0
(3 2)	1	0	0	1
(3 4)	1	0	0	1
(3 5)	0	1	1	0
(4 1)	0	1	1	0
(4 2)	0	1	1	0
(4 3)	1	0	0	1
(4 5)	1	0	0	1
(5 1)	1	0	0	1
(5 2)	0	1	1	0
(5 3)	0	1	1	0
(5 4)	1	0	0	1

Table 2. Occurrence of sequences in the design of Table 1.

Selecting the Optimal Design: By considering the structure of Table 2, you can determine a lower bound on the number of subjects needed to achieve perfect balance. A design which fills each cell with a 1 will have a variance of zero for position, sequence, and sequence spread. In the case of 5 products, you would need 20 respondents, twice the amount in the Williams

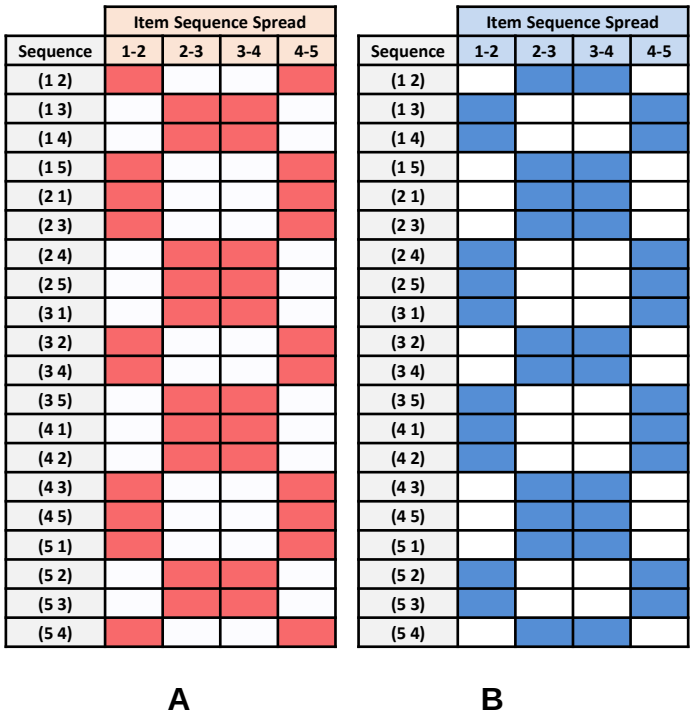


Figure 1. Sequence spread counts for the design in Table 1 (A) and its complement (B).

Design. More generally, as each respondent contributes one cell to each column, you would need $n * (n - 1)$ respondents where n is the number of products to be evaluated. Finding an actual optimal design is a challenging task due to the combinatorial nature of the problem, however, solutions have been found for many practical problem sizes. Table 3 shows one such design for 5 products.

Application to the Fragrance Study Design: You apply this approach to the Williams Design in Table 1 and obtain Table 3. This table can now be replicated and used in the fragrance CLT. The plan is to conduct this research with 300 recruited consumers, over-recruited to ensure at least 300. There are 15 sets of 20 to make up 300 rotations. However, there may be no-shows resulting in a sample size different from 300 and not an integer multiple of 20. In order to minimize the impact of a partial plan, you now consider how the partial sample should be drawn.

Rationale for Selecting the Final Design Fragment: As the final exact number of respondents is unknown, it is desirable to have an ordered design where each subsequent row keeps the cumulative variance as low as possible. Considering the counts, such as those in Table 2, along with graph theoretic tools, it is possible to find such an order that minimizes the variance of sequences or the variance of sequence spread, but not necessarily both. Since the effect of unbalanced sequences is expected to be larger than that of sequence spread, you choose to find a design which minimizes the former. These designs can be based on Williams Designs and in this case the design has 10 rows. You append these 10 rows to your original 300 and now have flexibility in the final number of respondents while maintaining low variance.

Rotation	Position 1	Position 2	Position 3	Position 4	Position 5
1	1	2	5	3	4
2	2	3	1	4	5
3	3	4	2	5	1
4	4	5	3	1	2
5	5	1	4	2	3
6	4	3	5	2	1
7	5	4	1	3	2
8	1	5	2	4	3
9	2	1	3	5	4
10	3	2	4	1	5
11	1	3	4	5	2
12	3	5	1	2	4
13	5	2	3	4	1
14	2	4	5	1	3
15	4	1	2	3	5
16	2	5	4	3	1
17	4	2	1	5	3
18	1	4	3	2	5
19	3	1	5	4	2
20	5	3	2	1	4

Table 3. A Williams design with 5 products and 10 rotations augmented with a design that is the complement of the sequence spread counts. This design perfectly controls for sequence spread with a multiple of 20 participants.

Conclusion: Rotations in tests of multiple items is a practical and important step in minimizing bias (getting more accurate responses) and improving precision in tests involving sequential monadic testing. It is not recommended to rely on randomized rotations or even replicated Williams Squares when an alternative that can account for sequence spread is available. The alternative discussed in this report provides a design that controls for all three conditions perfectly if the number of participants is a multiple of 20 and a least variance solution if the number of participants exceeds this number.

References

1. Ennis, D.M. and Rousseau, B. (Eds.) (2022). *Tools and Applications of Sensory and Consumer Science*, Parts 7. pp. 158-159; 164-167. Richmond, VA: The Institute for Perception.

2. Williams, E. J. (1949). Experimental designs balanced for the estimation of residual effects of treatments. *Australian Journal of Scientific Research*, Ser. A 2, 149-168.

From Invention to Innovation

Technical Change (Course 1): Identifying Consumer-Perceived Benefits (Nov. 7-8)
Product Development (Course 2): Drivers of Liking® and Computer-Aided Design (Nov. 9-10)

In-person or live-stream attendance

Course 1 or Course 2..... $700
Both Courses..... $1,300

A 10% discount will be applied to each additional registration when registered at the same time, from the same company.

We offer reduced fees (50%) for non-profit entities, academics, and government employees. Contact us to register with reduced fees.

Fee includes a course manual and a copy of our latest books. For those attending in-person, also included are food/beverage break refreshments, buffet lunches Tuesday through Thursday and a group dinner on Tuesday and Thursday.

Register online at www.ifpress.com/courses

Fee payment can be made online by credit card. If you qualify for a fee discount, or would like information about payment by invoice, please contact **Shannon Denton-Brown** before registering at mail@ifpress.com or call 804-675-2980.

LOCATION

The course will be held at The Greenbrier® in White Sulphur Springs, West Virginia. Nestled in the Allegheny Mountains, this gracious hotel is renowned for its hospitality and service.

LODGING

Lodging is not included in the course fee and participants must make their own hotel reservations. A block of rooms is being held at The Greenbrier at a special rate of **$209** *(plus resort fees & taxes)*. To make a reservation, please call **1-877-661-0839** and mention you are attending the ***Institute for Perception*** course (***note:*** *the special rate is not available through online reservations.)* To learn more about The Greenbrier, visit their website at www.greenbrier.com.

TRANSPORTATION

The Greenbrier Valley Airport (**LWB**) in Lewisburg is only a 15 min. shuttle ride from the hotel. Direct flights to LWB are available from Charlotte (**CLT**). Other airports include Roanoke, VA (**ROA,** 1hr. 15 min.), Charleston, WV (**CRW,** 2 hrs.), and Charlottesville, VA (**CHO,** 2 hrs. 15 min.).

CANCELLATION POLICY

Registrants who have not cancelled two working days prior to the course will be charged the entire fee. Substitutions are allowed for any reason.

For biographical information, please visit www.ifpress.com

Dr. Daniel M. Ennis
President,
The Institute for Perception

Dr. Benoît Rousseau
Sr. Vice President,
The Institute for Perception

William Russ
Computational Market Researcher and Lead Programmer,
The Institute for Perception

Anthony Manuele
Molson Coors Beverage Company
- Retired Vice President of Global Brewing, Quality, Innovation, and Technical Governance

Dulce Paredes
Consumer Navigator LLC.