



Puzzling from incomplete pieces... (pgs. 3 & 4)

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Drivers of Liking[®] with Incomplete Block Designs

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TECHNICAL REPORTS:

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- 25(2) Drivers of Liking® with Incomplete Block Designs
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- 24(2) *Compared to What?* Controls in Advertising Claims Substantiation
- 24(1) Generating Optimal Sample Presentation Orders

2020

- 23(4) Unfolding Financial Markets
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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.

President's Message

And the Winners are...

I am delighted to acknowledge the two outstanding students who were selected for our 2021 Institute for Perception award. The winner was **Heather McCain Keefer** (left), a student of Prof. MaryAnne Drake of North Carolina State University, and the runner-up was **Cristhiam Gurdian Curran** (right), a student of Prof. Witoon Prinyawiwatkul of Louisiana State University.



November brings us back to the leafy fall environs of the Greenbrier in White Sulphur Springs, WV for our upcoming courses. The first one (Nov. 8) is a one-day training program using the R software. This software has become a universally accepted tool to access an enormous array of statistical and data science models. The R Training course is followed by a 2 1/2 day course on Drivers of Liking® (Nov. 9-11) which includes standard and new techniques to guide new product innovation. Our next webinar, on September 15th, will focus on selecting the best sensory methodology in a step-by-step process.

I look forward to seeing you at one of our upcoming programs and I hope you enjoy this quarter's newsletter on incomplete block designs in consumer product testing.

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

WEBINAR CALENDAR:

- SEPTEMBER 15, 2022** Thursday at 2:00 PM ET, 75 minutes
- **Selecting the Right Sensory Method: A Step-by-Step Guide**
- DECEMBER 15, 2022** Thursday at 2:00 PM ET, 75 minutes
- **R for Sensory Scientists: Part 1 - Foundations**

EVENT CALENDAR:

- NOVEMBER 8-11, 2022** at The Greenbrier, White Sulphur Springs, WV and live streamed via Zoom
- **R Training - November 8**
 - **Drivers of Liking®: Principles and Application - November 9 - 11**

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

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WEBINAR: September 15th at 2:00 ET

**Selecting the Right Sensory Method:
A Step-by-Step Guide**

Taught by: Dr. Benoît Rousseau

In this webinar, we will review a series of steps needed to conduct successful methodological comparisons. Of particular importance is the use of Torgerson’s method of triads, analyzed using Thurstonian models, to select pairs of samples that will represent small, medium, and large sensory differences to ensure meaningful conclusions. Real industrial examples will be used to illustrate theoretical and practical applications.

This webinar is intended for a general audience of sensory professionals, market researchers, and product developers.

Attendance only (\$269) Recording only (\$289) Attendance & Recording (\$359)

▶ **REGISTER ONLINE at www.ifpress.com/webinars**

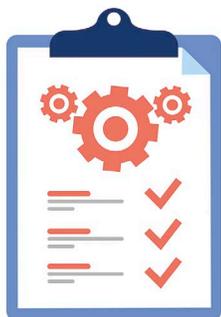


The selected student will receive a \$1,000 award and a complimentary invitation to attend any Institute for Perception course. We will be accepting applications for the 2022 Institute for Perception Student Award beginning in September 2022.

All entries must be postmarked or emailed by **Saturday, JANUARY 21, 2023**
For complete details and application form, go to: www.ifpress.com/student-award

(We invite you to visit our website, www.ifpress.com, to see all of our full-service consulting capabilities.)

PROJECT MANAGEMENT



We provide full-service market research including all aspects of a project from design to data analysis and custom results reporting. We conduct market research for clients in a variety of industries including foods and beverages, personal care, home/pet care, pharmaceuticals, cosmetics, and digital services using our global testing network.

Analyses

In addition to standard statistical tools, we have extensive experience in developing and employing advanced statistical analyses and emerging computational tools. These include machine learning methods and predictive modeling, unfolding such as Landscape Segmentation Analysis (LSA)[®], advanced TURF and other segmentation methods and methods to design optimum product bundles of consumer-relevant drivers.

Study Designs

We use our proprietary experimental design expertise to minimize bias by using optimal rotations in sequential monadic designs.

Reports

Our reports provide insights for varied audiences of business teams in informative and insightful formats. We tell the story of your research findings.

WEBINAR LIBRARY

▶ **ORDER RECORDINGS AT www.ifpress.com/webinars**

Sensory Difference Tests

- Replicated Preference Testing to Diagnose Consumer Segmentation
- Introduction to Thurstonian Modeling – 1 & 2
- Advances in Tetrad Testing
- Precision of Measurement in Sensory Difference Testing
- How to Calculate Consumer Relevant Risk using Sensory Difference Tests
- Preference without a Significant Sensory Difference
- Developing Consumer Relevant Action Standards for Sensory Difference Testing
- Discrimination Testing with Batch-to-Batch Variability
- Derived Preference and Difference from Applicability Scoring
- Capitalizing on Historical Consumer Data
- Developments in Discrimination Testing for Sensory Equivalence
- Sensory Discrimination Testing

Advertising Claims Support

- Supporting Numerical Superiority Claims
- Claiming Equivalence, Unsurpassed, and Superiority Simultaneously
- Issues in Supporting “Up-to” Claims
- Supporting Count-Based Sensory Advertising Claims

Drivers of Liking[®] and Landscape Segmentation Analysis[®]

- Mapping Techniques to Link Consumer & Expert Data
- Maximizing Consumer Insights by Contrasting Blind and Branded Test Findings
- Unfolding Financial Markets
- Preference Mapping vs. LSA[®]
- Capitalizing on Historical Consumer Data
- Drivers of Liking[®] with Incomplete Block Designs and Missing Data

Combinatorial Tools

- Finding New Opportunities using Graph Theory
- Introduction to TURF
- Introduction to Graph Theoretic Tools
- eTURF 2.0: TURF Solution for Datasets of All Sizes
- Large TURF Problems: Finding Custom Solutions

Design Issues in Product Tests and Surveys

- The Science of Answering Questions
- Developments in Applicability & CATA Scoring
- Removing Experimental Biases in Sensory and Consumer Research Data
- Sequential Product Testing

Innovation

- Invention and Innovation

Machine Learning

- Consumer Segmentation via Machine Learning
- Action Standards for Machines and Humans in Quality Assurance
- Text Analysis of Open-Ends
- Turbo-Charging Consumer Analytics – 1 & 2

Background: Incomplete block (IB) designs¹ were originally constructed to improve precision in agricultural experiments by limiting exposure to variability within blocks and thus improve the reliability of treatment comparisons. Their use in product testing arises from the practical fact that respondents (blocks) sometimes cannot (or should not) be exposed to the full set of products to be tested. IB designs provide a convenient approach to setting up incomplete sets of products to be tested by individuals and analyzed using Landscape Segmentation Analysis® (LSA). LSA² assumes that a liking response depends on a combination of past and present experience. The method, called unfolding, provides the basis for identifying individual ideal and item points in a low-dimensional space of hedonic drivers. Typically, in consumer product categories, the drivers of liking space is two- or three-dimensional. Figure 1 displays the concept of unfolding through the action of unfolding a fan. In the folded, or barely unfolded, state a fan displays images that later may appear in different parts of the space. Inspecting the fan in the folded state provides very little information about the complex images that unfolding will generate. Images of the same color seen on the folded fan may appear surprisingly different and in different locations when the fan is unfolded.



Figure 1. Unfolding a fan.

Scenario: You work as a data science manager for a market research supplier and provide design and analysis services for large consumer product clients. Your clients conduct sequential monadic product tests through your company on a regular basis. LSA is one of the tools you use to study comparative performance of your clients' and their competitors' products. Typically, these studies involve complete tests where every participant evaluates every product, but periodically there is a need for incomplete block designs. These designs arise because sometimes it is impractical to require every respondent to evaluate every product. Although you have used complete datasets when using LSA in the past, and you know that incomplete data can be analyzed using LSA, you have questions about its use with incomplete block experiments.

These questions are: At what level of incompleteness does LSA become unreliable regarding product placements when products have

1. Similar liking means,
2. Dissimilar liking means.

These are important questions because product placements determine the identification of liking drivers, and the comparative liking performance of the products depends on their relative locations. In addition, the location of individual ideal points may also influence both outcomes.

Theoretical Expectations: If the liking means for a set of products are identical, and if the ideal points are uniformly distributed in the space, then the theory and the process underlying LSA makes certain predictions. One of these predictions is that the products tested will be expected to be located on a circle in two dimensions or on the surface of a sphere in three dimensions. This is the configuration that will explain the identical product means best. This was demonstrated in the images displayed in the fan in Figure 1 and in a previous technical report². If product means are different, the location of product and ideal points will appear in the drivers of liking space in a pattern and locations that optimally accounts for individual ratings. An incomplete block design may not contain enough information to properly locate the product points, and this could affect the identification of the liking drivers. It is useful to know the degree of incompleteness that is acceptable so that the best incomplete block design can be chosen for an application.

Generation of the Incomplete Block Designs: In order to evaluate the level of incompleteness that you can accept, you design simulated tests based on previous actual product tests. Using the **CR&S method**³ (Column Randomization and Search) for generating complete and incomplete block designs in IFFPrograms^{®4} you create datasets for two levels of incompleteness. The CR&S method uses a computer-intensive search method to find designs that meet position, sequence and sequence spread equality criteria across the design. Using this method reduces the likelihood of bias due to product positions and sequences in the design. You construct a set with 8 products per block (complete) and an incomplete case with 4 products per block. In this case, respondents are distributed randomly in the drivers of liking space and the product means are almost identical as shown

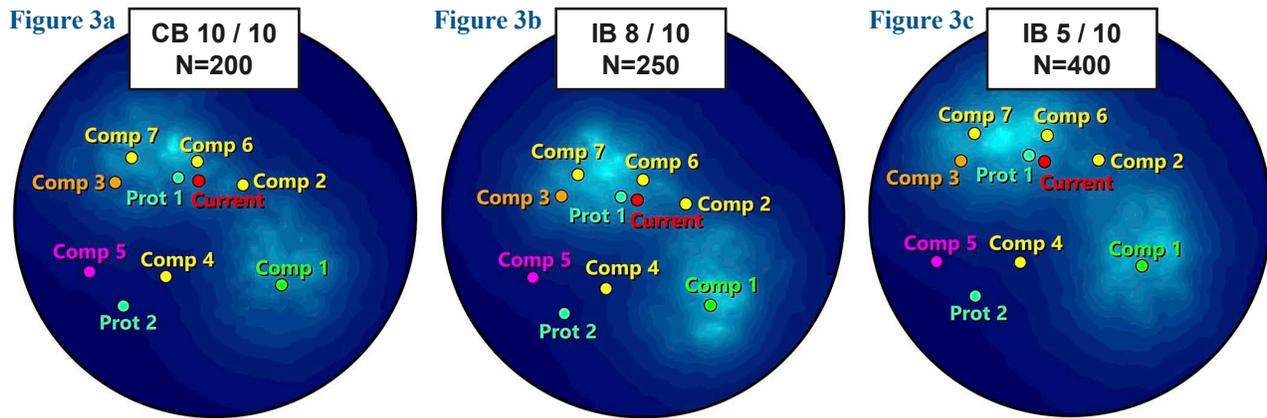
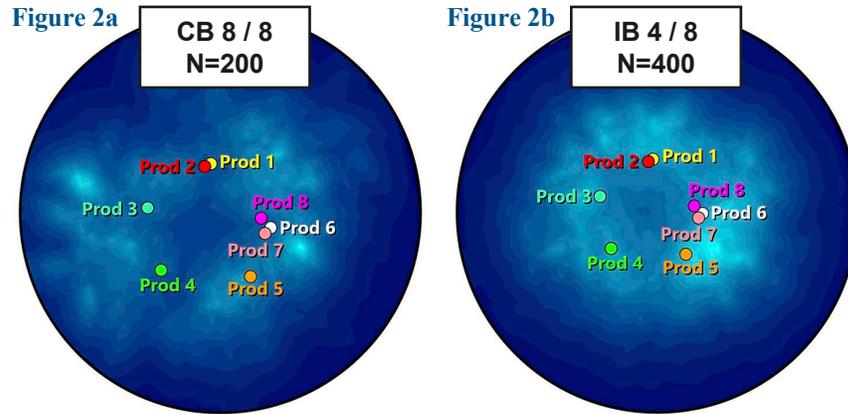
Product	Mean
Product 8	8.11
Product 7	8.08
Product 2	8.06
Product 1	8.04
Product 6	8.03
Product 3	8.01
Product 4	7.99
Product 5	7.98

Table 1. Liking means for 8 very similarly liked products on a 9-point scale.

Product	Mean
Current Product	7.14
Prototype 1	7.03
Competitor 2	6.94
Competitor 6	6.89
Competitor 4	6.38
Competitor 7	6.21
Competitor 3	6.11
Competitor 1	6.09
Prototype 2	5.06
Competitor 5	4.91

Table 2. Liking means for 10 products on a 9-point scale.

Figures 2a - b. LSA results for the complete dataset of 8 products (2a) and for a block size of 4 (2b.)



Figures 3a - c. LSA results for the complete dataset with blocks of size 10 (3a) and for the blocks of size 8 (3b) and 5 (3c).

in Table 1. You ensure that each product is evaluated by the same number of respondents irrespective of the degree of incompleteness. This means that the total number of participants for an incomplete block design will be greater than a corresponding complete block design. For example, a complete block design of 200 participants evaluating 8 products corresponds to 400 participants evaluating only 4 products each.

For a more extensive set of products, you use blocks of 10 (complete), 8, and 5 products per block. In this case you also simulate two large segments to evaluate the effect of respondent locations on the product locations as the degree of incompleteness increases. The product means are quite different as shown in Table 2.

The Effect of Incompleteness on Product Locations:

Figures 2a-b show the LSA results for the complete dataset (2a) of 8 products and for a block size of 4 (2b.) The location of the 8 products in a circle is due to their almost identical means and occurs as expected and the products are clustered on the circle similarly for the 8 and 4 block cases. Figures 3a-c show the LSA results for the complete dataset (3a) with blocks of size 10 and for the blocks of size 8 and 5. It can be seen from these figures that in the presence of strong segmentation the product locations are maintained as the degree of incompleteness increases, at least to the level of blocks sizes of 5 out of 10. Increasing the degree of incompleteness further may cause an unacceptable level of product shift in the drivers of liking space which would have consequences for the reliability of the liking drivers.

These results are similar to those obtained by Cleaver when he compared methods using incomplete block designs⁵. You conclude that, as a rule, you will require that incomplete block designs should not have blocks with a block size of less than 50% of the complete design block size to maintain the integrity of the product locations, whether there is strong segmentation or not and whether the product means differ or not. In two-dimensions the lower limit for block size per individual to properly locate an individual’s ideal point is 3. In three-dimensions it is 4. Choosing a minimum of 50% of the total product set size and meeting the analytic minimum of 3 and 4, depending on dimensionality, appears to be an appropriate choice.

Conclusion: Incomplete block designs can be fit to the LSA unfolding model and will provide reliable results provided that the level of incompleteness is not extreme. The general recommendation is that the block sizes should not be less than 50% of the complete block size and there should be a minimum of 4 products per block.

References

1. Cochran & Cox (1992). *Experimental Designs*. New York: Wiley.
2. Ennis, D.M. (2020) Analytical approaches to accounting for individual ideal points. In Ennis, D. M. and Rousseau, B (Eds.) *Tools and Applications of Sensory and Consumer Science* (pp. 92-93). Richmond, VA: The Institute for Perception.
3. Ibid, pp. 92-121
4. IFPrograms® software, Tools version, The Institute for Perception, Richmond, VA
5. Cleaver, G. (2010) Sensometrics Conference, Amsterdam.

R Training

November 8th at The Greenbrier in White Sulphur Springs, WV and also live-streamed via Zoom.

With advances in computer and data science and the enormous opportunity to share software applications, one statistical software application has stood out as a real game-changer. That software tool is called R. R is an open-source resource that provides access to tools by some of the greatest minds in statistics and data science. These tools include all the basic statistical methodologies but also cutting-edge methods that are only now developing in academic and industrial centers around the world. Learning how to use R effectively creates in the user enormous potential to approach routine and advanced tasks with ease.

In this course, you will:

- Learn what R is and how you can make use of it in your daily work
- Use R Studio to write and manage scripts
- Develop facility with the most useful commands and learn how R is structured
- Import data from a wide variety of sources and learn how to clean and manipulate it
- Write your own functions and export results in graphical and numerical form
- Manage multiple projects

TUESDAY

November 8, 8am - 4pm ET

► Welcome and introductions

► Introduction to R

- R and RStudio®
- How to write scripts
- Useful commands

► Data Analysis

- Importing data
(Including CSV, XLSX, SPSS, SAV, etc.)
- Data wrangling, cleaning, and manipulation
- Functions for statistical analyses
- Packages and libraries

► Scripting and Project Management

- Writing custom functions
- Data Structures
- Visualization
- Data export



Drivers of Liking Principles and Applications

November 9-11 at The Greenbrier in White Sulphur Springs, WV and also live-streamed via Zoom.



Marrying hedonic data with sensory descriptive and analytical information is necessary to understand what drives consumer liking. Many analytical options have been available over the years, but they often will not result in the same

conclusions. One analysis might find sweetness to be an attribute driving liking, while another might not. One technique might uncover clear population segmentation, while another might not. How can you choose the most suitable approach? What are each approach's underlying analytical assumptions and how likely are they to deliver trustworthy results and insights? In this course we will review commonly used techniques to understand why consumers like some products and dislike others and identify the strengths and weaknesses of each technique.

We will introduce Landscape Segmentation Analysis® (LSA) which is a tool specifically developed to link liking to possible explanatory variables such as sensory and analytical inputs for multiple consumer segments.



Since reliable insights cannot be learned without reliable data, we will also describe experimental approaches that maximize data quality when selecting test products and generating sample presentation orders.

In this course, you will:

- Learn how to select optimal sets of products for a Drivers of Liking® project and generate presentation orders that minimize common experimental biases
- Compare different liking models and understand why they might not always reach the same conclusions, and learn how to select the most suitable approach
- Construct maps with products and consumer ideal points and identify population segmentation
- Uncover a category's drivers of liking using descriptive and analytical data
- Learn how to combine different analytical tools such as LSA and conjoint analysis or decision trees for deeper insights
- Use mapping results to improve existing products
- Conduct product portfolio optimization

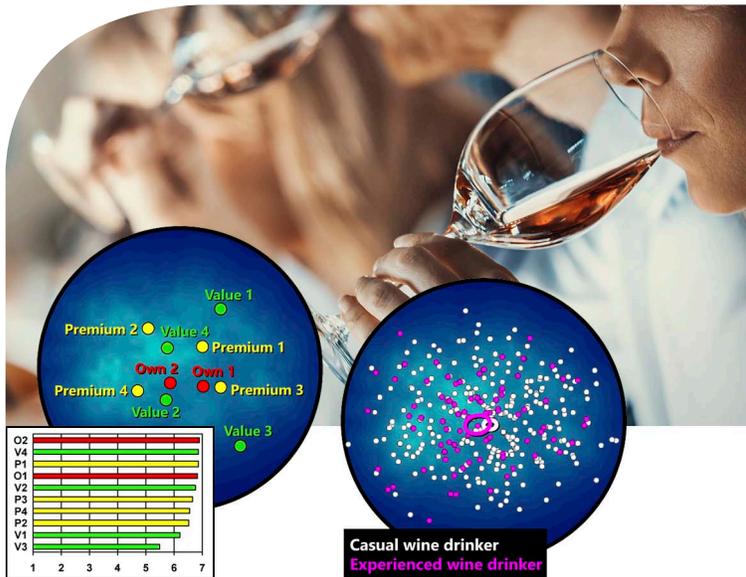
IFPROGRAMS® AND R SOFTWARE

The course instruction includes software to perform analyses and exercises. Prior to the course, you will be sent information by email to install R and RStudio® to be used on Tuesday, and IFPrograms® to be used Wednesday-Friday. To introduce you to the capabilities of IFPrograms®, you will also receive a complimentary 3-month trial of the Professional version used for an extensive collection of 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.)

WEDNESDAY

November 9, 8am - 4pm ET

- ▶ Introduction of the two course projects:
 - Chocolate chip bitterness reduction research (**Project 1**)
 - Cookie ingredient change (**Project 2**)
- ▶ Why link consumer and sensory data?
- ▶ Overview of the sensory and Drivers of Liking® (DOL) spaces
- ▶ How to approach a category appraisal (*IFPrograms® exercises*)
 - Product selection using graph theory
 - Method comparison to generate sample presentation orders (random, Williams Squares, CR&S)
 - Multiple day effect, complete vs. incomplete block designs
- ▶ Two common analytical mapping options (*IFPrograms® exercises*)
 - Factor analysis (**Project 1**) and external preference mapping (**Project 2**)
 - Assumptions and potential limitations of the two techniques
- ▶ Review of the background to mapping consumer hedonic data: modeling liking, biplots, unfolding
- ▶ Introduction to Landscape Segmentation Analysis® (LSA)
 - Successive analytical steps
 - Modeling approach
- ▶ Applications of LSA principles to **Project 1** (*IFPrograms® exercises*)
 - **Project 1:** LSA on consumer data
 - Product space generation
 - Investigation of the drivers of liking space
 - Illustration of weak and strong DOLs
 - Comparison to previous factor analysis results



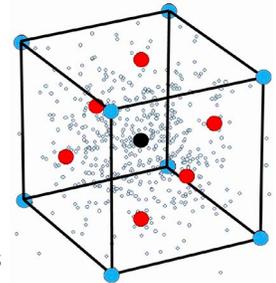
FOR YOUR CONTINUED STUDY...

To enhance your continued study, you will receive a printed manual with all presented slides and a copy of our current books, *Tools and Applications of Sensory and Consumer Science* and *Thurstonian Models: Categorical Decision Making in the Presence of Noise*.

THURSDAY

November 10, 8am - 4pm ET

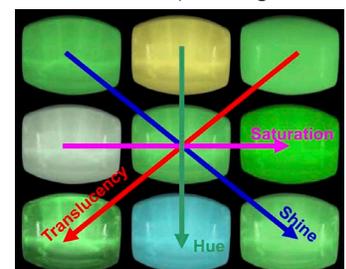
- ▶ Applications of LSA principles to **Project 2** (*IFPrograms® exercises*)
 - **Project 2:** LSA on consumer data
 - Product space and DOLs
 - Color coding of consumers based on segmentation
 - Investigation of demographic effects
 - Comparison to previous external preference mapping results
- ▶ A comparison of LSA and internal preference mapping
 - Contrasting assumptions and outputs
 - Three-dimensional solution example – The “Cube”
 - Application to 27 real-world category appraisals
- ▶ A comparison of LSA and external preference mapping
 - Illustration of differential consumer fits
- ▶ Diagnosing the need for a three-dimensional solution
 - Application to an orange juice example (*IFPrograms® exercises*)
- ▶ Going beyond the Drivers of Liking® space 1: Predicting new product success
 - Conditions for successful predictions
 - Applications to Projects 1 and 2 (*IFPrograms® exercises*)



FRIDAY

November 11, 8am - Noon ET

- ▶ Going beyond the Drivers of Liking® space 2: Creating optimal product sensory profiles and portfolios
 - Portfolio optimization strategies: Maximizing consumer satisfaction and maximizing First Choice (*IFPrograms® exercises*)
 - **Project 1:** Maximizing consumer satisfaction with one or two products
 - **Project 2:** Maximizing First Choice based on own products and main competitor
- ▶ Next level learning: Using incomplete block designs
 - Situations where a complete block design is not possible
 - Generation of rotations for incomplete block designs
 - Comparison of outputs between complete blocks and incomplete block scenarios (*IFPrograms® exercises*)
- ▶ LSA applications to other types of consumer generated data using IFPrograms software (*IFPrograms® exercises*)
 - Applications of LSA in the beer category
 - Measuring brand effects on consumer landscape using 10 white wines
 - Motivations for product consumption
 - Moisturizing and refreshing properties of soap bar images
 - Usage occasions
 - Food concept preferences of children and adults
- ▶ Review of course principles and conclusions



REGISTRATION

R Training

Tuesday, November 8, 2022

R Training only, in-person or via Zoom..... \$495

Drivers of Liking®

Wednesday, November 9 - Friday, November 11, 2022

In-person attendance at The Greenbrier... \$1,890*

Live stream attendance via Zoom..... \$1,575*

*Includes complimentary R Training on the first day. For academic and multiple registration discounts, contact us before registering.

Register Online: www.ifpress.com/nov-2022-courses

Fee includes:

- ▶ Printed manuals of slides and software exercises
- ▶ A printed copy of our book, *Tools and Applications of Sensory and Consumer Science* and a PDF download of our book: *Thurstonian Models: Categorical Decision Making in the Presence of Noise*
- ▶ Food and beverage refreshments each day, plus lunch and dinner on Tues. - Thurs. for attendees at The Greenbrier
- ▶ A 3-month free trial of **IFPrograms®** Professional version

Register online at www.ifpress.com/courses where payment can be made by credit card. A fee discount is available for students and multiple registrations. If you qualify for a discount or need information about payment by invoice, please contact **Susan Longest** at mail@ifpress.com or call 804-675-2980 before registering.

LOCATION: The course will be presented at The Greenbrier® in White Sulphur Springs, WV. 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 **\$205** (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, America's resort since 1778, 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 on United Airlines from Chicago O'Hare (**ORD**) and Washington Dulles (**IAD**). 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.

The Institute for Perception

These courses have been developed for technical and supervisory personnel involved in all aspects of sensory and consumer research.

The concepts covered have valuable applications in product development, quality assurance, marketing and advertising claims departments of consumer product companies.

THESE COURSES WILL ALSO BE PRESENTED VIA **Zoom**

If you are unable to attend in person, these courses will also be live streamed via Zoom. If you attend virtually, you will be sent a link by email with instructions on how to join the meeting with the speakers and other attendees. All supporting materials will be mailed to you before the event, so please register early to allow for sufficient shipping time.

SPEAKERS

For detailed biographical information, please visit www.ifpress.com/nov-2022-courses



Dr. Daniel M. Ennis

The Institute for Perception
- President



Dr. Benoît Rousseau

The Institute for Perception
- Senior Vice President



William (Will) Russ

The Institute for Perception
- Computational Market Researcher
and Lead Programmer



Anthony (Manny) Manuele

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

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