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Review Article

Developing an Inner Psychophysics for Social Issues: Reflections, Futures, and Experiments

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Abstract

This paper introduces Inner Psychophysics, a new approach to measuring the values of ideas, applying the approach to the study of responses to 28 different types of social problems. The objective of Inner Psychophysics is to provide a number, a metric for ideas, with the number showing the magnitude of the idea on a specific dimension of meaning. The approach to create this Inner Psychophysics comes from the research system known as Mind Genomics. Mind Genomics presents the respondent with the social problem, and a unique set of 24 vignettes presenting solutions to the problem. The pattern of responses to the vignettes is deconstructed into the contribution of each 'answer', through OLS (ordinary least squares) regression. The approach opens up the potential of a 'metric for the social consensus,' measuring the value of ideas relevant to society as a whole, and to the person in particular.

Introduction

Psychophysics is the oldest branch of experimental psychology, dealing with the relation between the physical world (thus 'physics') and the subjective world of our own consciousness (thus 'psycho'). The question might well be asked what is this presumably arcane psychological science dealing with up to date, indeed new approaches to science? The question is relevant, and indeed, as the paper and data will show. The evolution of 'inner psychophysics' provides today's researcher with a new set of tools to think about the problems of the world. The founder of today's '*modern psychophysics*,' the late S.S. Stevens (1906-1973) encapsulated the opportunity in his posthumous book, 'Psychophysics: An Introduction to its Perceptual, Neural and Social Prospects. Stevens also introduced the phrase 'a metric for the social consensus,' in his discussions about the prospects of psychophysics in the world of social issues. This paper presents the application of psychophysical thinking and disciplined rigor to the study of how people 'think' about large-scale societal problems [1,2].

The original efforts in psychophysics began about 200 years ago, with the world of physiologists and with the effort to understand how people distinguish different levels of the same stimulus, for example, different levels of sugar in water, or today, different levels of sweetener in cola. Just how small of a difference can we perceive? Or, to push things even more, what the is lowest physical level that we can detect? [3] These are the difference and the detection threshold, respectively, both of interest to scientists, but of relatively little interest to the social scientist and researcher.

The important thing to come out of psychophysics is the notion of '*man as a measuring instrument*,' the notion that there is a metric of perception. Is there a way to assign numbers to objects or better to experiences of objects? In simpler terms, think of a cup of coffee. If we can measure the subjective perception of aspects of that coffee, such as its coffeeness', then what happens when we add milk. Or add sugar. Or change coffee roast, and so forth. At a mundane level, can we measure how much perceived 'coffeeness' changes? With that in mind can we do this type of measurement for social issues?

Steven's 'Outer' and 'Inner' Psychophysics

By way of full disclosure, author HRM was one of the last PhD students of the SS Stevens, receiving his PhD in the early days of 1969. Some 16 months before, Stevens had suggested that HRM '*try his hand*' at something such as taste or political scaling, rather than pursuing research dealing with topics requiring sophistication in electronics, such as hearing and seeing. That suggestion would become a guide through a 54-year future, now a 54-year history. The notion of measuring taste forced thinking about the mind, the way people say things taste versus how much they like what they taste. This first suggestion, studying taste, focused attention on the inner world of the mind, one focused on what things taste like, why people differ in what they like, whether there are basic taste preference groups, and so forth. The well-behaved and delightfully simple regularities, '*change this, you get that*,' working so well in loudness, seem to break down in taste.

If taste was the jumping off point from this outer psychophysics to the measurement of feelings such as liking, then the next efforts would

be even more divergent. How does one deal with social problems which have many aspects to them? We are no longer dealing with simple ingredients, which when mixed create a food, and whose mixtures can be evaluated by a 'taster'. We are dealing now with the desire to measure the perception of a compound, complex situation, the resultant of many interacting factors. Can the spirit of psychophysics add something, or we stop at sugar coffee, or salt in pickles?

Some years later, through ongoing studies of perception, it became obvious that one could deal with the inner world, using man as a measuring instrument. The slavish adherence of systematic change of the stimulus in degrees and the measurement, had to be discarded. It would be nice to say that a murder is six times more serious than a bank robbery with two people injured, but that type of slavish adherence would not create this new inner psychophysics. It would simply be adapting and changing the hallowed methods of psychophysics (systematically change, and then measure), moving from tones and lights to sugar and coffee, and now to statements about crimes. There would be some major efforts, such as the utility of money [4], efforts to maintain the numerical foundations of psychophysics because money has an intrinsic numerical feature. Another would be the relation between perceived seriousness of crime and the measurable magnitude punishment. But there had to be a profound re-working of the problem statement.

Enter Mathematics: The Contribution of Conjoint Measurement, and Axiomatic Measurement Theory

If psychophysics provided a strong link to the empirical world, indeed a link which presupposed real stimuli, then mathematical psychology provided a link to the world of philosophy and mathematics. The 1950's saw the rise of interest in mathematics and psychology [5]. The goal of mathematical psychology in the 1950's and 1960's was to put psychology on firm theoretical footing. Eugene Galanter became an active participant in this newly emerging, working at once with Stevens in psychophysics at Harvard, and later with famed mathematical psychologist R. Duncan Luce. Luce and his colleagues were interested in 'fundamental measurement' of psychological quantities, seeking to measure psychology with the same mathematical rigor that physicists measured the real world. That effort would bring to fruition the Handbook of Mathematical Psychology [6], and the work of Luce and Tukey [7] well as the efforts of psychologist Norman Anderson [8] who coined the term 'functional measurement.'

The simple idea which is relevant to us is that one could mix test stimuli, ideas, not only food ingredients, instruct the respondent to evaluate these mixtures, and estimate the contribution of each component to the response assigned to the mixture. Luce and Tukey suggested deeply mathematical, axiomatic approaches to do that. Anderson suggested simpler approaches, using regression. Finally, the pioneering academics at Wharton Business School, Paul Green and Yoram (Jerry) Wind showed how the regression approach could be used to deal with simple business problems [9,10].

The history of psychophysics and the history of mathematical psychology met in the systematics delivered by Mind Genomics. The mathematical foundations had been laid down by axiomatic measurement theory. The objective, systematized measurement of experience, had been laid down by psychophysics at first, and afterwards by applied psychology and consumer research. What remained was to create a 'system' which could quantify experience in a systematic way, building databases, virtually '*wikis of the mind*', rather than simply providing one or two papers on a topic which solved a problem with an interesting mathematics. It was time for the creation of a corpus of psychophysically motivated knowledge, an inner psychophysics of thought, rather than the traditional psychophysics of perception.

Reflections on the Journey from the Outer Psychophysics to an Inner Psychophysics

New thinking is difficult, not so much because of the problems as the necessity to break out of the paradigms which one 'knows' to work, even though the paradigm may no longer serve its purpose in an optimal fashion. Inertia seems to be a universal law, whether the issue be science and knowledge, or business. This is not the place to discuss the business aspect, but it is the place to shine a light on the subtle tendency to stay within the paradigms that one learned as a student, the tried and true, those paradigms which get one published.

The beginning of the journey to inner psychophysics occurred with a resounding NO, from S. S. Stevens, in 1967, when author HRM asked permission to combine studies of how sweet an item tasted, and how much the item was liked. This effort was a direct step away from simple psychophysics, with the implicit notion of a 'right answer'. This notion of a 'right answer' summarizes the worldview by Stevens and associates that psychophysics was searching for, invariance, for 'rules' of perception. Departures from the invariances would be seen as the irritating contribution of random noise, such as the 'regression effect' [11], wherein the tendency of research is to underestimate the pattern of the relation between physical stimulus and subjective, judged response. "Hedonics" was a complicating, 'secondary factor', which could only muddle the orderliness of nature, and not teach anything, at least to those imbued with exciting Harvard psychophysics of the 1950's and 1960's.

The notion of cognition, hedonics, experience as factors driving the perception of a stimulus, could not be handled easily in this outer psychophysics except parametrically. That is, one could measure the relation between the physical stimulus and the subjective response, create an equation with parameters, and see how these parameters changed when the respondent was given different instructions, and so forth. An example would be judging the apparent size of a circle of known diameter versus judging the actual size. It would be this limitation, this refusal to accept ideas as subject to psychophysics, that author HRM would end up attempting to overcome during the course of the 54-year journey.

The course of the 54-year journey would be marked by a variety of signal events, events leading to what is called in today's business 'pivoting.' The early work on the journey dealt with judgments of likes and dislikes, as well as sensory intensity [12]. The spirit guiding the work was the same, search for lawful relations, change one parameter, and measure the change in a parameter of that lawful relation. The

limited, disciplined approach of the outset psychophysics was too constraining. It was clear at the very beginning that the rigorous scientific approaches to measuring perceptual magnitudes using 'ratio-scaling' would be a 'non-starter.' The effort of the 1950's and 1960's to create a valid scale of magnitude was relevant, but not productive in a world where the application of the method would drown out methodological differences and minor issues. In other words, squabbles about whether the ratings possessed 'ratio scale' properties might be interesting, but not particularly productive in a world begging for measurement, for a yet-to-be sketched out inner psychophysics.

The movement away from simple studies of perceptual magnitudes was further occasioned by the effort to apply the psychophysical thinking to business issues, and the difficulties ensuing in the application of ratio scaling methods, such as magnitude estimation. The focus was no longer on measurement, but on creating sufficient understanding about the stimulus, the food or cosmetic product, so that the effort would generate a winner in the marketplace.

The path to understanding first comprises experiments with mixtures, first mixtures of ingredients, and then mixtures of ideas, steps needed to define the product, to optimize the product itself, and then to sell the product. Over time, the focus turned mainly to ideas, and the realization that one could mix ideas (statements, messages), present these combinations to respondents, get the responses to the combinations, and then using statistics such as OLS (ordinary least-squares regression) one could estimate the contribution of each idea in the mixture to the total response.

Inner Psychophysics Propelled by the Vision of Industrial-scale Knowledge Creation

A great deal of what the author calls the "Inner Psychophysics" came about because of the desire to create knowledge at a far more rapid level than was being done, and especially the dream that the inevitable tedium of a psychophysical experiment could simply be eliminated. During the 20th century, especially until the 1980's, researchers were content to work with one subject at a time, the subject being call the 'O', an abbreviation for the German term *Beobachter*. The fact that the respondent is an observer suggests a slow, well-disciplined process, during which the experimenter presents one stimulus to one observer, and measures the response, whether the response is to say when the stimulus is detected as 'being there,' when the stimulus quality is recognized, or when the stimulus intensity is to be assigned a response to report its perceived intensity.

The psychophysics of the last century, especially the middle of the 20th century, focused on precision of stimulus, and precision of measurement, with the goal of discovering the relations between variables, viz., physical stimuli versus perception of those stimuli by the person. It is important to keep in mind the dramatic pivot or change in thinking that would ensue when reality and opportunity presented themselves as disturbances. Whereas psychophysics of the Harvard format searched for lawful relations between variables (physical stimulus levels; ratings of perceived magnitude), the application of the same thinking to food and to ideas was to search for usable relations. The experiments need not reveal an 'ultimate truth', but rather needed to be 'good enough,' to identify a better pickle, salad dressing, orange juice or even features of a cash-back credit card.

The industrial-scale creation would be facilitated by two things. The first was a change in direction. Rather than focusing one's effort on the laws relating physical stimulus and subjective response (outer psychophysics), the new, and far-less explored area would focus on measuring ideas, not actual physical things (inner psychophysics).

The second would focus on method, on working not with single ideas, but deliberately with mixtures of ideas, presented to, and evaluated by the respondent. in a controlled situation. These mixtures of ideas, called vignettes, would be created by experimental design, a systematic prescription of the composition of each mixture, viz., which phrases or elements would appear in each vignette. The experimental design ensured that the researcher could link a measure of the respondent's thinking to the specific elements. The rationale for vignettes was the realization that single ideas were not the typical 'product' of experience. We think of mixtures because our world comprises compound stimuli, mixtures of physical stimuli, and our thinking in turn comprises different impressions, different thoughts. Forcing the individual to focus on one thought, one impression, one message or idea, is more akin to meditation, whose goal is to shunt the mind away from the blooming, buzzing confusion of the typically disordered mind, filled with ideas flitting about.

The world view was thus psychophysics, search for relations and for laws. The world view was also controlled complexity, with the compound stimulus taking up the attention of the respondent and being judged. The structure of the mixtures appeared to be a '*blooming, buzzing confusion*' in the words of Harvard psychologist William James. To create the Inner Psychophysics meant to prevent the respondent from taking active psychological control of the situation. Rather, the designed forced the respondent to pay attention to combinations of meaningful messages (vignettes), albeit messages somewhat garbled in structure, which avoided revealing the underlying structure, and thus prevented the respondent from 'gaming' the system.

As will be shown in the remainder of this paper, the output of this mechanized approach to research produced an understanding of how we think and make decisions, in the spirit of psychophysics, at a pace and scope that can be only described as industrial scale/

The Mind Genomics 'Process' for Creating an Experiment

The study presented here comes from a developing effort to understand the mind of ordinary people in terms of what can solve well-known social problems. At a quite simple level, one can either ask respondents to tell the researcher what might solve the problems, or present solutions to the respondent, and ask the respondent to scale each solution in terms of expected ability to solve the problem. The solutions are concrete, simple, relevant. The pattern of responses gives a sense of what the respondent may be thinking with respect to solving a problem.

The study highlighted here went several stages beyond that simple, straightforward approach. The stimulus for the underlying

thinking came from traditional personality theory, and from cognitive psychology. In personality theory, psychologist Rorschach among many others believed that people were not often able to paint a picture of their own mind, at the deepest levels. Rorschach developed a set of ambiguous pictures and required the respondent to describe them, to tell a story. The pattern of what the respondent saw could tell the research how the respondent organized her or his perceptions of the world. Could such an approach be generalized, so that the pictures would be replaced by metaphoric words, rich with meaning? And so was born the current study. The study combines a desire to understand the mind of the individual, the use of Mind Genomics to do the experiment, and the acceleration of knowledge development through a novel set of approaches to the underlying experimental design (see also Goertz & Mahoney) [13]

Let us first look at the process itself.

1. The structure of the experimental design begins with a single topic (e.g., a social problem), continues with four questions dealing with the problem, and in turn four specific answers to each question. Thus, there are three stages, easy to create, amenable to being implemented through a template. Good practice suggests that the 16 answers (henceforth elements) be simple declarative statements, 14 words or fewer, with no conjunctives. These declarative statements should be easily and quickly scanned, with as little attention, as little 'friction' as possible.
2. A basic experiment specified 24 unique combinations or vignettes, each vignette comprising 2, 3 or 4 elements. No effort was made to connect these elements. Rather, each element was placed atop the other.
3. The experimental design ensured that each element appeared exactly five times across the 24 vignettes, and that the pattern of appearances made each element statistically independent of the other 15 elements.
4. The experimental design was set up to allow the 24 vignettes to be subject to OLS (ordinary least-squares) regression, at the level of the individual, or the level of the group, respectively.
5. A key problem in experimental design is the underlying structure of what is tested, which is a single set of combinations. The quality of knowledge suffers because only a set of combinations is tested, one small region of the design space. There is much more to the design space. The researcher's resources are wasted suppressing the noise in this region, either by eliminating noise (impossible in an Inner Psychophysics), or by averaging out the noise in this region by replication (a waste of resources).
6. The solution of Mind Genomics is to permute the experimental design [14]. The permutation strategy maintains the structure of the experimental design but changes the specific combinations. The task of permuting requires that the four questions be treated separately, and that the elements within a question be juggled around but remain with the question. In this way, no element was left out, but rather its identification number changed. For example, A1 would become A3, A2 would become A4, A4 would become A2 and A3 would become or remain A3. At the initial creation of the permuted designs, each new design was tested to ensure that it ran with the OLS (ordinary least-squares) regression package.
7. Each respondent would test a different set of 24 combinations. *What was critical was to create a scientific experiment in which the experiment need not know anything about the topic to explore the full range of the topic as represented by the 16 elements.* The data from the full range of combination tested would quickly reveal what elements performed well, and what elements performed poorly.
8. The benefit to research was that research could become once again exploratory as well as confirmatory, due to the wide variation in the combinations. It was no longer a situation of knowing the answer or guessing at the answer ahead of time. The answer would emerge quickly.
9. Continuing and finishing with an overview of the permuted design of Mind Genomics, it quickly became obvious that studies needed not be large nor expensive. The ability to create equations or models with as few as 5-10 respondents, because of the ability to cover the design space, meant that one could get reasonable indications with so-called 'demo studies', virtually automatic studies, set up and implemented at low cost. The setup takes about 20 minutes once the ideas are concretized in the mind of the research. The time from launch (using a credit card to pay) to delivery of the finalized results in tabulated form, ready for presentation, is approximately 15-30 minutes.
10. It was important to create rapid summarizations of the results. Along with the vision of 'industrial strength research' was the vision of 'industrial scale insights.' These would be provided by simple templated outputs, along with AI interpretations of the strong performing elements for each key group in the population. The latter would develop into the AI 'summarizer'.
11. The final step, as of this writing is to make the above-mentioned system work simultaneously with a series of different studies, e.g., 25-30 studies, in an effort to create powerful databases, across topics, people, cultures, and over time. In the spirit of accelerated knowledge development, each study is a carbon copy of the other study, except for one item, the specific topic being addressed in the study. That is, the orientation, rating scale, and elements are identical. What differs is the problem being addressed.
12. When everything else is held constant, only the topic being varied, we have then the makings of the database of the mind, done at industrial scale.

Applying the Approach to the 'Solution' of Social Problems

We begin with a set of 28 social problems, and a set of 16 'messages' as tentative solutions to a problem. The problems are simple to describe

and are not further elaborated. In turn the 16 elements or solutions are general approaches, such as the involvement of business, rather than more focused solutions comprising specific steps. These 28 problems are shown in Table 1 and the 16 solutions are shown in Table 2.

The 28 problems enumerated in Table 1 represent a small number of the many possible problems one can encounter, and Table 2 shows a few of the many the solutions that might be applied. The number of problems is unlimited. For this introductory study, using the Mind Genomics template, we are limited to four types of solutions for a problem, and four specific solutions in each type.

The actual process follows these steps, which give a sense of the total effort needed for the project.

1. Develop the base study (orientation page, rating scale, questions, answers); Figures 1a and 1b shows some relevant screen shots. Each problem is represented by a single phrase describing the problem. That phrase is called 'the SLUG'. It will be the SLUG which changes in the various steps, one SLUG for each study (Figure 2).

Table 1: The 28 problems.

1	Abortion	10	Gay Hatred	19	Personal Hacking
2	Anger	11	Global Warming	20	Police Cruelty
3	Asian Hatred	12	Insurrection	21	Political Deadlock
4	Black Voting	13	Internet Crime	22	Poverty
5	College Expenses	14	Irresponsible. Politicians	23	Race Hatred
6	Covid Vaccine	15	Loss of Hope	24	Religious Hatred
7	Economic Gaps	16	Lying Politicians	25	Search for Truth
8	Election Hacking	17	Medical Access	26	Social Security
9	Firearms	18	Parenting	27	Tyranny
				28	Venal Politicians

2. Create a copy of the base study, changing the nature of the problem in the introduction and in the rating scale. This activity requires about 3-5 minutes for each study due to its repetitive, simple nature. Then launch each study in rapid succession with the same panel requirements (50 respondents), and let each study amass the data from the 50 respondents. The field time is about 30 minutes when the studies are launched during the daytime, and when the respondents have been invited by an on-line panel provider specializing in this type of research.

Table 2: The 16 solutions (four silos, each silo with four solutions).

	Answer group 1: Education
A1	Embedding the issue in school curriculum
A2	Promote the voice of young students
A3	Recruiting teachers who are activists in their communities
A4	Promote educational messaging with subject matter experts
	Answer group 2: Activism
B1	Create self-help movements
B2	Start a protest and improve conditions within the government
B3	Create a riot to overthrow the government
B4	Promote social media activism
	Answer group 3 – Business actions
C1	Put company executives on the ground floor to understand and act on the issue
C2	Rely on business innovation to provide the solution
C3	Embedding issue within business operations
C4	Big spending philanthropic initiatives by businesses
	Answer group 4 – Government actions
D1	Create laws and legislation to prevent the issue
D2	Provide government funding
D3	Public outreach through mailers and mass messaging
D4	Incentivize behaviors...tax breaks

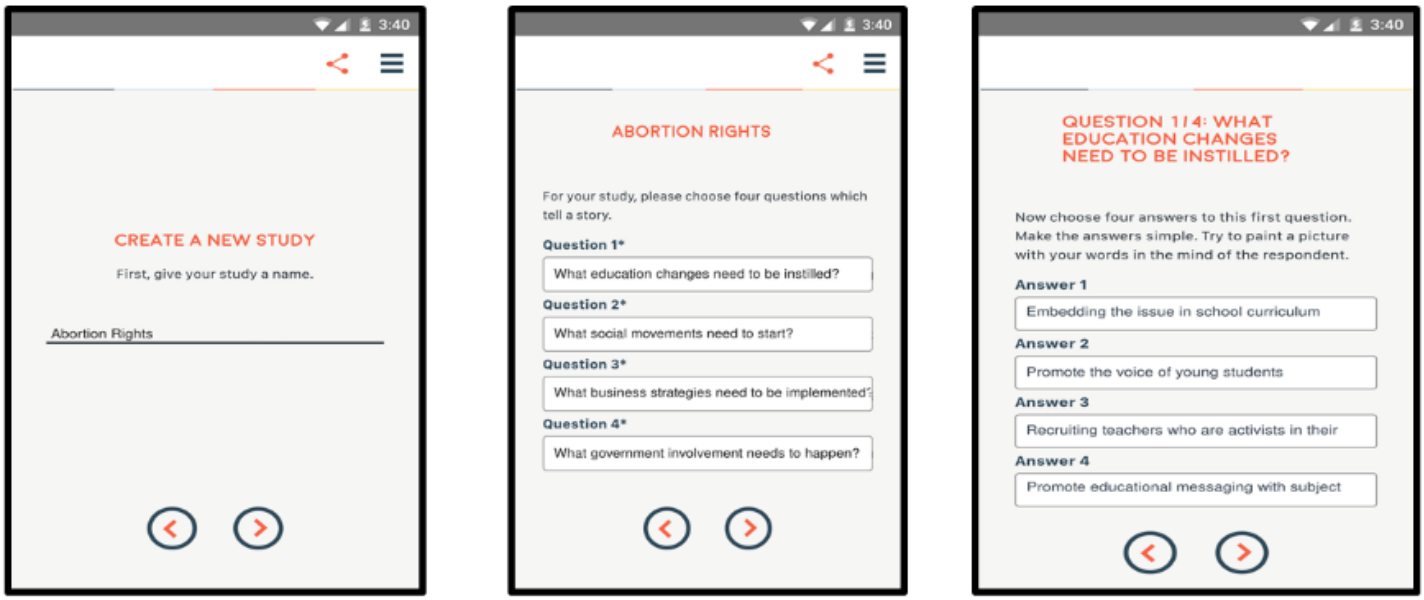

Figure 1: Study name (left panel), four questions (middle panel), and four answers to one question (right panel).

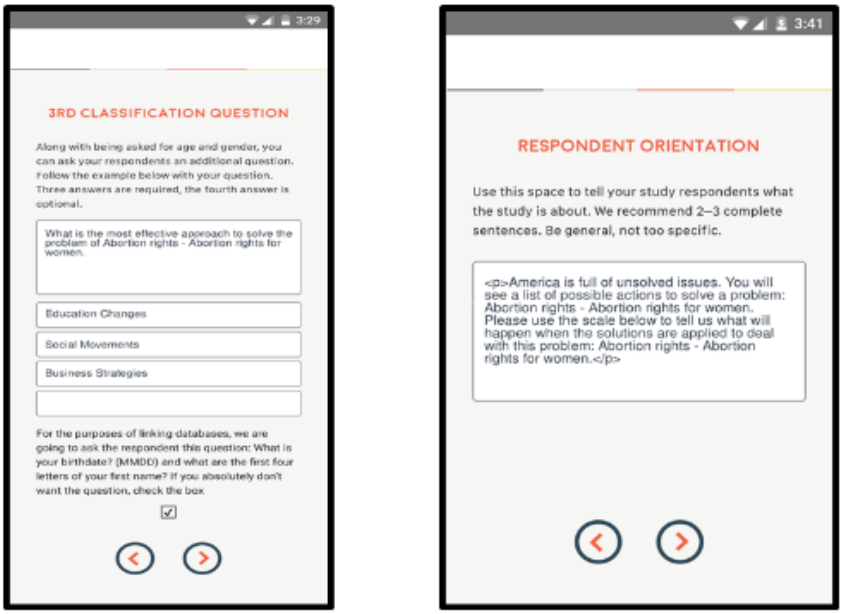

Figure 2: Self profiling question (left panel), and rating scale (right panel).

The expected time for Step 2 for 28 studies is about 3-4 hours, to acquire all of the data.

3. Create the large scale datafile, comprising one set of 24 rows for each respondent. This effort ends up being simple a 'cut and paste' effort, with slight editing. The 24 rows of data per respondent ends up generating 1200 rows of data for each of the 28 studies. The final database will comprise the information about the study, about the respondent, and then the set of 16 columns to show the presence/absence of the 16 elements (answers to the question), as well a 17th column to show the rating assigned for the particular vignette, and an 18th column showing the 'response time' for the vignette, defined as the time between the appearance of the vignette on the respondent's screen and the assignment of the rating.

4. Pre-process the ratings by converting the 5-point rating scale to a new, binary scale. Ratings of 1-3 are converted to 0 to denote that the respondent does not feel that the combination of offered actions presented in the vignette will 'solve' the problem. In turn, ratings of 4-5 are converted to 100 to denote that the respondent does feel that the combination of offered actions will solve the problem. The binary transformation is generally more intuitive to users of the data, these users wanting to determine 'no or yes.' To these users the intermediate scale values are hard to interpret, even though those scale values are tractable for statistical analysis.

5. Since the 24 vignettes evaluated by a respondent are created according to an underlying experimental design, we know that the 16 independent variables (viz., the 16 solutions) are statistically independent of each other. Thus, the program creates an equation or model relating the presence/absence of the 16 elements to the newly created binary variable 'will work.' We express the equation as: Work (0/100) = k_1(Solution A1) + k_2(Solution A2) + …. K_{16}(Solution D4). To make the results comparable instant from the study to study the *equation is estimated without an additive constant, to force all the information about the pattern to emerge from the coefficients.*

6. Each respondent thus generates 16 coefficients, the 'model' for that respondent. The coefficient shows the number of points on a 100-point scale for 'working' contributed by each of the 16 solutions. Array all the coefficients in a data matrix, each row corresponding to a respondent, and each column corresponding to one of the 16 solutions or elements.

7. Cluster all respondents in the 28 studies into three groups *independent of the problem topic*, but simply based on the pattern of the 16 coefficients for the respondent. The clustering is called k-means [15]. The researcher has a choice of the measure of distance or dissimilarity. For these data we cluster using the so-called Pearson Model, where the distance between two respondents is based on the quantity (1-R), with R=Pearson Correlation Coefficient. The Pearson correlation coefficient for two respondents is computed across computed across the 16 pairs of coefficients). Note again that the clustering program 'does not know' that there are 28 studies. The structure of the data is the same from one study to another, from one respondent to another.

8. Each respondent is assigned to one of the three clusters (now called mind-set). Afterwards, the researcher create summary models or equations, first for each study independent of mind-set, second for each mind-set independent of study, and finally for each combination of study and the three mind-sets. These summary models generate four tables of coefficients, first for total, and then for mind-set 1, mind-set 2, and mind-set 3, respectively. Each vignette clearly belongs to one of the respondents, and therefore belong both to one specific study of

the 28, and to one of the three emergent mind-sets. For these final summary models, the (arbitrary) decision was made to discard all vignettes that were assigned the rating '3' (cannot decide). This decision sharpens the data by considering only the vignettes where a respondent felt that the problem would be solved or not be solved.

9. Build three large models or equations relating the presence/absence of the 16 elements (specific solutions) to the binary rating of 'can solve the problem', incorporating all respondents in a mind-set. Then build the three sets of models, for each problem, by respondents in the appropriate mind-set. This creates 28 (problems) x 3 (mind-sets) = 84 separate models. We look at the patterns across the tables to get a sense of the different mind-sets, how they differ from the Total Panel, and what seems to be the defining aspects for each mind-set.

10. The effort for one database, for one country, easy easily multiplied, either to the same database for different countries, or different topic databases for the country. From the point of view of cost in today's dollars (Spring, 2023), each database of 28 studies and 50 respondents per study can be created for about $15,000, assuming that the respondents are easy to locate. That effort comes to about $500 per study.

What Patterns Emerge from Problem-Solution Linkages – Total Panel

Let us now look at the data from the total panel. Table 1 shows us 16 columns, one per solution, and 28 rows, one per problem. Models were estimated after excluding all vignettes assigned the rating 3 (cannot decide). The table is sorted in descending order by ability for a specific solution, and from left to right, by median coefficient, both for solutions and for problems, respectively:

1. The rows (problems) are sorted in descending order by the median coefficient for the problem across 16 solutions. This means that the problems at the top of the table are those with the highest median coefficients, viz., the most likely to be solved by the solutions proposed in the study.. The problems at the bottom of the table are those least likely to be solved by the solutions proposed in the study

2. The columns (solutions) are sorted in descending order by the median coefficient for the solution across all 28 problems. This means that the solutions to the left, those with the highest median coefficients, are the most to solve problems. The solutions to the right, those with the lowest median coefficients, are least likely to solve problems.

3. The medians are calculated for all coefficients, those shown and those not shown. The table shows only the strong performing combinations, those with coefficients of +20 or higher.

4. Table 3 is extraordinarily rich. There are several strong-performing elements. The interesting observations, however, emerges from the pattern of darkened cells, those with strong coefficients. These tend to be solutions from group B (social action) and from group C (business). Initiatives from education and government do work, but without any additional information, there seems to be little belief in the efficacy of the public domain to produce a solution.

The Lure of Mind-sets

We finish this investigation by looking at mind-sets, one of the key features of Mind Genomics. The notion of mind-sets is that for each topic area one can discover different patterns of 'weights' applied by the respondent to the information. The analysis to create these mind-sets will use the 16 coefficients for each respondent, independent of the problem presented to the respondent.

The notion of combining all respondents, independent of the problem, may sound strange at first, but there is a spark of reason. We are simply looking at the way the person deals with a problem. We are more focused on general patterns, even if these end up being 'weak signals.' The fact that there are 28 different problems dealt with in the project is not relevant for the creation of the mind-set, but will become important afterwards, for the deeper understanding of each mind-set.

The rationale for combining problems and solutions (viz., coefficients) into one database comes from the well-accepted fact that consumers differ when they think about purchasing a product. Studies of the type presented here, but on commercial products, again and again show that when it comes to purchasing a food product, one pattern of weights suggests that the respondent pays attention to product features, whereas another pattern of weights applied to the same elements suggests that the respondent pays attention to the experience of consuming the product, or the health benefits of the product, rather than paying attention to the features [16]. Rarely do we go any deeper in our initial thinking about the individual differences.

1. The coefficients for the three emergent mind-sets appear in Tables 2-4. Again, the tables are sorted by the median, and all coefficients of 20 or higher are shaded to allow the patterns to emerge. Our task here is to point out some of these general patterns.

2. The range of coefficients is much larger for the mind-sets than for the total. Table 1 shows us many modest-size coefficients of 10-20 and a number of larger coefficients, 20 or higher. Tables 2-4 show us a much greater range of coefficients. We attribute the increased range to the hypothesis that people may deeply differ from each other in their mental criteria. Inner Psychophysics reveals that difference, doing so dramatically, and in a way that could not have been done before.

3. The pattern of coefficients seems somewhat more defined, as if the respondents in a mind-set more frequently rely on the same set of solutions for the problems, although not always.

a. The mindsets do not believe that the key solutions will work everywhere, but just in some areas. The mind-sets do not line up in an orderly fashion. That is, we do not have a simplistic set of psychophysical functions for the inner psychophysics. We do have patterns, and metrics for the social consensus.

b. Mind-Set 1 (Table 2) appears to feel that *business and*

Table 3: Summary table of coefficients for model relating presence/absence of 16 solutions (column) to the expected ability to solve the specific problem.

Total Panel:	**Median ability of problem to be solved across 16 solutions**	**Create self-help movements**	**Create a riot to overthrow the government**	**Promote social media activism**	**Embedding issue within business operations**	**Rely on business innovation to provide the solution**	**Big spending philanthropic initiatives by businesses**	**Start a protest and improve conditions within the government**	**Put company executives on the ground floor to understand and act on the issue**	**Create laws and legislation to prevent the issue**	**Embedding the issue in school curriculum**	**Promote the voice of young students**	**Incentivize behaviors...tax breaks**	**Provide government funding**	**Promote educational messaging with subject matter experts**	**Public outreach through mailers and mass messaging**	**Recruiting teachers who are activists in their communities**
		B1	**B3**	**B4**	**C3**	**C2**	**C4**	**B2**	**C1**	**D1**	**A1**	**A2**	**D4**	**D2**	**A4**	**D3**	**A3**
Median Power of solution across 28 problems		19	19	19	18	17	17	17	17	16	15	15	14	14	13	13	**13**
Medical Access	22	21	22	23	24	23			25	24		23		22		21	**22**
Loss of Hope	20	24	21	20	22		23			26		21	22	20		22	
Race Hatred	20	22	20	24				22		23	20		25	23		20	
Police Cruelty	19	21			23	20	23					21			20		**23**
Tyranny	19				21	21					24	24		22	25		**25**
Search for Truth	18	20	31			22	26										
Irresponsible. Politicians	18	27	22	25					21								
Black Voting	18	22	21		20			21	21								
Parenting	17	23	20	20	26	25	27	26	32								
Anger	17				23		21		22				23				
Social Security	17					22	22		21								
Global Warming	17						20			21							
Poverty	16											22			20		
Personal Hacking	16			23			26		21								
Abortion	16		20		26	25				22				21			
Religious Hatred	16	21		23				20		24			22				
Asian Hatred	15		20						20								
Gay Hatred	15	25	21					20						20			
Internet Crime	15						21			25							
Firearms	15											20					**22**
Election Hacking	15																
College Expenses	14	23			26	20	25										
Political Deadlock	14								21								
Economic Gaps	13																
Lying Politicians	13			21													
Covid Vaccine	13	20		23					21								
Insurrection	12																
Venal Politicians	12			21	20		21	22	23								

Table 4: Summary table of coefficients for model relating presence/absence of 16 solutions (column) to the expected ability to solve the specific problem (row). The data come from Mind-Set 1, which appears to focus on business as the preferred solution to problems.

Mind-Set 1 (business)	**Median ability of problem to be solved across 16 solutions**	**Big spending philanthropic initiatives by businesses**	**Rely on business innovation to provide the solution**	**Embedding issue within business operations**	**Put company executives on the ground floor to understand and act on the issue**	**Promote the voice of young students**	**Embedding the issue in school curriculum**	**Start a protest and improve conditions within the government**	**Recruiting teachers who are activists in their communities**	**Promote educational messaging with subject matter experts**	**Create a riot to overthrow the government**	**Create self-help movements**	**Promote social media activism**	**Create laws and legislation to prevent the issue**	**Incentivize behaviors…tax breaks**	**Public outreach through mailers and mass messaging**	**Provide government funding**
		C4	**C2**	**C3**	**C1**	**A2**	**A1**	**B2**	**A3**	**A4**	**B3**	**B1**	**B4**	**D1**	**D4**	**D3**	**D2**
Median Power of solution across 28 problems		26	26	25	24	22	20	20	19	19	19	19	18	4	1	**0**	**-1**
Tyranny	23	20	34	38	22	24	28	21	27	24	28	25					
Truth	22	30	30	24	24	26	23	22	20		28	20	25				
Black Voting_	22	26			28	24		34	21	23	42	37	23				
Irresponsible Politicians	22	23	30		32			23	21	26	29	36	28				
Medical Access	22	28	34	37	38	29	23		33	24	20		20				
Personal Hacking	21	42	28	31	36	22	32		23	23	20						
Race Hatred	21	20	25	21	26	22	23	22	20	22			24	21			
Venal Politicians	20	29	27	25	33	22		27	20	21			22				
Firearms	20	25	27	28	21	31	20	25	32		26			-			
Police Cruelty	20	33	22	30	21		20		25		20	22	24				
Parenting	20	38	27	28	37			36			39	43	25	-			
Anger	19			28	23			23		24		25	23				
Loss of Hope	18	30	28	26		29	24	20			27		27				
Global Warming	18	39	34	36	23		21	20				31					
College Expenses	18	33	31	37	22							26					
Abortion	17	28	33	31	26			22				20					
Asian Hatred	17	34	31	36	38	29				32							
Social Security	17	33	25	23	30	25	22	22									
Internet Criminal	17	26							27	30	24	22	21				
Election Hacking	16		26	33		29	24			20							
Gay Hatred	15	20					22	20									
Political Deadlock	15	27		24	24				22		21			-			
Economic Gaps	15			22		25	20		23	27							
Religious Hatred	15	22			24		20	27			23	23	30				
Lying Politicians	14	21					20	20				20	20				
Poverty	13	33	25		30	35	31		35	29							
Covid Vaccine	12				27	33	35			27							
Insurrection	10																

education solutions will work most effectively. Mind-Set 1 does not believe strongly in the public sector as able to provide workable solutions to many problems.

c. Mind-Set 2 (Table 3) appears to feel that *education and the law* will work most effectively.

d. Mind-Set 3 (Table 4) appears to feel that *law and business* will work most effectively (Tables 4-6).

Discussion and Conclusion

The focus of this paper began with the desire to extend the notion of psychophysics to the measurement of internal ideas. As noted in the first part of this paper, the traditional focus of psychophysics has been the measurement of sensory magnitudes, and later lawful relations between the sensory magnitude as perceived and the physical magnitude as measured by standard instruments.

The early work in psychophysics focused on measurement, the assignment of numbers to perceptions. The search for lawful relations between these measured intensities of sensation and physical correlates would come to the fore even during the early days of psychophysics, in the 1860's, with founder Gustav Theodor Fechner [17]. It was Fechner who would trumpet the logarithm 'law of perception,' such 'laws' being far more attractive than the very tedious effort to measurement the just notice differences, the underlying units of so-called sensory magnitude. Almost a century later Harvard psychophysicist S.S. Stevens (1975) would spend decades suggesting that this law of perception followed a power function of defined exponent, rather than a logarithmic function.

This paper moves psychophysics inward, away from the search for lawful 'equations' relating one set variables to another, viz., magnitudes of physical stimuli versus magnitudes of the co-varying subjective responses. This focus here is to measure ideas. The objective is to put numbers onto ideas, not by having the respondent introspect and rate the ideas, but rather by showing the magnitude of the linkage in the mind between ideas. The methods are experimentation, the results are numbers (coefficients of the equation), and the scope is to create this new iteration of psychophysics in a way consonant with the way we think about issues. The outcome comprises a set of relatively theory-independent methods which produce the raw material of this psychophysics for the consideration of both other researchers and for practical applications in the many areas of human endeavor.

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