

## Review Article

# The Mind Genomics Metaphor -From Measuring the Every-Day to Sequencing the Mind

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## Abstract

The presented study gives an additional meaning to the word 'Genomics'. In contrary to its traditional meaning, this paper introduces a method which is able to map consumer minds similarly to genome sequencing methods in molecular biology. Mind Genomics is not a traditional genomic method; it is used as a metaphor, since it uses expressions, or short stories to uncover the subconscious thinking of consumers about certain topics. The obtained information is used to differentiate so-called mind-sets, or alleles, which consist of people having similar opinions about the given topic. The agreement of respondents within the mind-sets is high, although there are significant differences between them. Mind genomics is a universal tool, giving the opportunity to researchers, entrepreneurs, students, everyone to use and sequence the mind of people about a topic of interest.

**Keywords:** Big Mind; Mind Genomics; Mind Sequencing; Segmentation

## Introduction

The world of genomics has exploded in a ferocity of research, the sophistication of method, the intermediate successes, and the lure of Nobel Prizes all contributing to the ferocity. At the same time, those who have done science for decades are seeing something else emerging, something which sadly disappoints rather than enthralls. That something, for lack of a better term, is blinding reductionism. Many science practitioners do not know the 'Big picture' if there is actually such a thing. Practitioners know the latest, talk to each other and compete on the sophistication of knowing less and less, with more and more precision.

And thus, the rationale of this paper, which deals with the genomics metaphor, but works from the inside out, from a pointillist view of the mind to a holistic view of the mind and society, driven by the genomic metaphor. If one can find genomes which regulate the expression of characteristics and behavior, might it be possible to create a like structure for the mind?

The effort to create this thing called 'Mind Genomics' is the topic of this paper, specifically the philosophical underpinnings, but more important, the actual, operationally-defined activities. Mind Genomics is thus a catch-all phrase for a world view, which posits that one can look at the different aspects of the everyday, experienced world, and for each aspect, no matter how limited, tight, circumscribed, one can find different ways that a person makes decisions within the confine of that aspect. Or in other words, that commonly used phrase in colloquial English, the science of 'Different strokes for different folks.'

## Early Efforts-Experimental Design and Mathematical Psychology

Researchers in most fields know that the phenomena that they study result from a combination of factors. Although today's fashion is 'Data Mining,' look at co-variations of phenomena in the world, otherwise known as cross-sectional analysis, a deeper understand is gotten by studying how systematic changes in variables 'Drive' responses. Experimental design sets up the particular combinations so that one can measure the independent variables, measure the response (so-called dependent variable), and create

an equation showing how the independent variables may ‘drive’ the dependent variable. The equation is simply a summary of the possible relationships which may underlie the linked behavior-independent variables co-varying with dependent variables.

Within the world of experimental design lies a smaller world, mathematical psychology, the formalization of behavior as mathematical constructs, whose properties can be formalized and whose behavior can then be studied. This esoteric field gave rise, in the 1960’s, to the study of measurement theory, so-called axiomatic measurement theory. The objective was to define how the scientist could validly ‘Measure’ psychological constructs.

In their spare intellectual austerity, mathematical psychology and experimental design could never have given birth to Mind Genomics. They did because the ground-breaking work by R Duncan Luce and John Tukey in the early 1960’s in this world of axiomatic measurement theory gave rise to the study of response to mixtures of test stimuli. From the response, the mathematical psychologist wanted to erect a way to measure the components.

The foregoing austere world of measurement theory produced a gift for scientists, especially behavioral scientists. The gift is known as conjoint measurement. The original work in 1964, the first article of the first issue of the *Journal of Mathematical Psychology* [1] gives no sense of the seminal importance of conjoint measurement. It would be left to marketers at the University of Pennsylvania, notably the late Professor Paul Green, together with emeritus professor at Wharton, Yoram Wind, who would take this esoteric method of conjoint analysis, and turn it on its head applying it to understand the response to marketing-relevant mixtures.

## **The Contribution of Marketing Research to Mind Genomics**

Marketing research, also known as consumer research, consumer insights, and other cognate names, is the social science practice of knowing about ‘Consumers’ as they make choices among available offerings for products and services. Marketing research is more of a practice than a science, more of a collection of tools by which the interested party in the company or university can understand a person’s values, and how those values impact choice and other market-relevant behavior.

It was the contribution of Paul Green and Jerry Wind to conjoint analysis, which set the scene for the development of conjoint analysis as an easily usable tool, and in turn created the foundation for using the conjoint analysis method to erect the science that we deal with here, this metaphor-based science, Mind Genomics.

Green and Wind realized that conjoint measurement, despite its rigorous mathematics in the spirit of applied mathematics (Measurement Theory), was actually a good tool by which to understand consumer behavior. The rationale was obvious. The consumer is confronted with compound stimuli comprising alterna-

tives. When the consumer makes a decision to accept or reject one of these compound stimuli, such as a product or a service, to what does the consumer attend? It is not sufficient to say that the person chooses ‘A’ over ‘B’ when each comprises different mixtures of components, often the same components, present in different proportions, however.

## **Evolving from Products and Services to the Mind-One-Off Studies**

The origin of Mind Genomics was the application of conjoint analysis to the creation of products and services, deeply in the tradition of the market researcher. The original conjoint analysis required that the respondent, the human participant, evaluate pairs of test stimuli, so-called profiles or test concepts. The respondent was instructed to read the two profiles, and choose. The respondent was not instructed to rate feelings, or to describe why one profile was selected and the other not selected.

The mathematics of the conjoint analysis was difficult. Creating an underlying psychological metric from choices that a person makes is an involved, indirect method, requiring extensive computations. Today’s computers make that computation easy. What is NOT easy, however, is the explanation of the outcome, the explanation of just what the conjoint analysis delivers.

Green and Wind, and others such as psychologist Norman Anderson, recognized that one could go further by exposing the respondent to a set of systematically varied ‘Profiles’ (i.e., test combinations in the language of conjoint measurement), acquire the responses to these ‘Profiles,’ and then use regression to relate the presence/absence of the components of the ‘profiles’ to the ratings assigned by the respondent [2].

With the foregoing leap from paired comparisons and choice modeling, the basis of Mind Genomics was born. It was now easy to explain to the user of the information that the numbers assigned to the components of the ‘Profiles,’ (henceforth the elements or building blocks of the vignettes) were simply the degree to which each element drove the response ‘YES’ or ‘I’ll buy it,’ and so forth. Managers now welcomed the data because finally they could understand the value of conjoint analysis.

## **Evolving from a Long Process to a Transaction**

In the evolution of ideas there is the inevitable arc from complex and difficult to simple, almost trivial, with the word ‘Trivial’ not meant in a pejorative way, but rather used to emphasize the fact that it is simple, almost taken for granted. If this seems to be a truism whose validity is not really established, consider the effort decades ago to sequence a gene, and now the virtually over-the-transom tools one can buy inexpensively to sequence a whole person. To bring that reality home, and to hint at a potential ‘big application,’ think of the company 23 and me, which provides by mail sequence results based upon one’s saliva sample ([www.23andme.com](http://www.23andme.com)).

com) What was breakthrough, one-of-a-kind, noteworthy science a few decades ago is not an over-the-transom transaction for a few hundred dollars.

Just as gene sequencing has undergone the evolution from breakthrough science of an arduous nature to a mechanized, routinized system, so has Mind Genomics, this descendent from conjoint measurement of the middle 1960's. The advent of personal computers in the 1970's made it possible to do these conjoint studies with one's own APPLE II+ computer, later with an IBM, and later with any WINTEL or Apple Machine.

The advent of the more powerful PC's in the early 1990's, and the ubiquitous, ever-morphing, every-expanding Internet in the late 1990's allowed Conjoint Analysis itself to morph into a system called IdeaMap® [3]. IdeaMap® studies did the entire backbreaking labor in days, then hours, and now minutes. The researcher could define the topic, create the silos or categories of ideas, create the ideas, set up the study quickly on-line, acquire respondents, and run the study. What took days and weeks now took days, and usually hours. Further developments in 2017, as this paper is being written, have compressed the time to an hour, from beginning to end.

## Method

The easiest way to understand Mind Genomics is through a short case history. We present that case history here. The topic is the response to renewable energy. The topic can be virtually anything, with the focus either very wide, such as renewable energy, or very narrow, such as different ways of talking about the specific price of energy. Thus, Mind Genomics has the potential of encompassing virtually all topics of thought, from the very wide to the very focused, from issues of philosophy to the response of people to aspects of a single experience, such as sitting around a table for a lunch meal in a restaurant.

1. What is the topic? In this first step, we define the specific topic. The topic is the response of people in a specific region of south-eastern New York State, USA, to the notion of renewable energy in light of increasing problems with energy availability that they are likely to encounter in the next five years. We could choose a topic such as this, one that could be considered to be quite narrow and limited, yet a topic that Mind Genomics expands to a set of five silos or categories of related elements, each in turn comprising four elements.

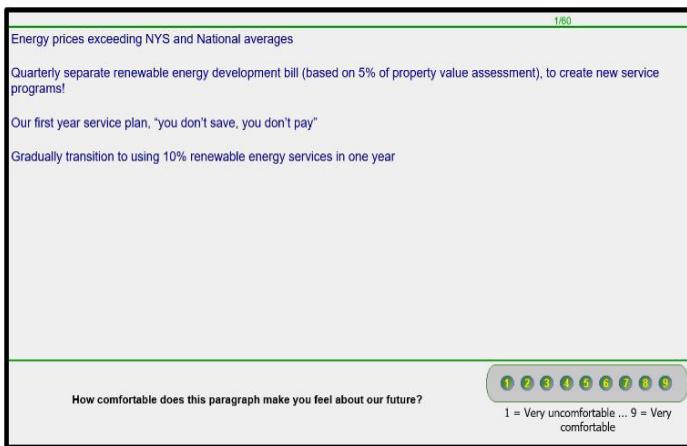
2. What are the raw materials? The raw materials are ideas, first expressed as general ones (silos), with each general idea or silo, in turn, comprising related messages. Mind Genomics requires the researcher to be disciplined, to select a defined set of silos, each with a defined, and equal number of messages. Table 1 presents the silos and the elements. Note that the silos are presented as 'questions' to be answered, and the elements are presented

as the 'Answers.' The strategy of asking questions and answering them helps the researcher to create a good set of elements. The questions, i.e., silo names, do not appear in the study.

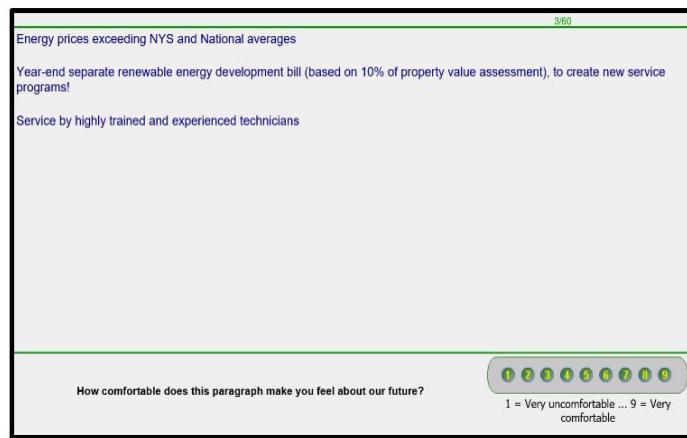
Silo A	What is the problem that you are facing?
A1	Rising energy prices.
A2	Inadequate supply of electricity.
A3	Closing Indian Point power station.
A4	Business relocating to other regions due to high-energy cost.
A5	Energy prices exceeding NYS and National averages.
Silo B	What can the government do in terms of increasing cost to defray problem.
B1	Increase county tax by 10% for renewable energy development services.
B2	Increase county tax by 15% for renewable energy development services.
B3	Increase county tax by 20% for renewable energy development services.
B4	Year-end separate renewable energy development bill (based on 10% of property value assessment), to create new service programs!
B5	Quarterly separate renewable energy development bill (based on 5% of property value assessment), to create new service programs!
Silo C	What type of service can be offered to make sure your home is energy efficient?
C1	Free energy conservation evaluation...personal in-home/in-business.
C2	Service by highly trained and experienced technicians.
C3	Free yearly re-evaluation of all energy service plans.
C4	Several choices of renewable energy plans.
C5	Our first-year service plan, "you don't save, you don't pay".
Silo D	How long will it take to transition to the more expensive, but ecologically better, renewable energy?
D1	Gradually transition to using 10% renewable energy services in one year.
D2	Gradually transition to using 20% renewable energy and 80% conventional energy.
D3	Gradually transition to using 50% renewable energy in two years.
D4	Gradually transition to using 80% renewable energy and 20 % conventional energy.
D5	Implement five-year plan for gradual increased use of renewable energy.

**Table 1:** The four silos and the five elements per silo.

3. How do you create the test stimuli? The test stimuli are short, easy to read vignettes (combinations of the elements), at most one element from each of the four silos in Table 1, but often only two or three elements present in a vignette [4]. Figures 1 & 2 show two examples of vignettes, Figure 1 showing a vignette comprising four elements, Figure 2 showing a vignette comprising three elements.



**Figure 1:** Example of a vignette comprising four elements, one element from each of the four silos.



**Figure 2:** Example of a vignette comprising three elements, one element from each of three silos, with the fourth silo absent from the vignette.

The vignettes may appear to be a hodge-podge of elements, thrown together, virtually at random. Nothing can be further from

the reality. The elements are combined according to an experimental design, appropriate for the number of silos and the number of elements within a silo. The experimental design dictates the specific combinations to be created. Each element appears an equal number of times. Many vignettes lack silos, and are incomplete. This absence of silos from a vignette, dictated by experimental design, is done so that the array of vignettes can be analyzed by OLS (ordinary least-squares) regression, without the fear of multicollinearity [5].

Each respondent evaluates a vignettes array according to the experimental design. Each respondent evaluates a unique set of combinations, but a full experimental design. All respondents, in fact, evaluated vignettes created by the same basic design structure. Only the specific combinations of elements varied, the variation done deliberately in order for the vignettes as a group to cover a lot of the potential combinations that could be constructed [6,7]. This systematic permutation allows Mind Genomics to become a 'learning machine' about specific topics of thought, even though the researcher is starts from zero knowledge.

4. How do you introduce the respondent to the study? Mind Genomics studies are done on the Internet. The respondent is invited to participate, clicks on a link in the invitation email and is brought to the site. Most respondents do not know what to do when they get to the site. The orientation page, shown in Figure 3, represents one of the typical types of orientation pages. Figure 3 presents an orientation in somewhat greater detail than is often the case. The respondent reads the orientation page, typically quickly and with little interest, proceeding to the evaluation of the different vignettes.

In Figure 3 the reader will note that at the bottom of the orientation page there is an offer for a sweepstakes prize for participants. The usual approach is to work with respondents who are either recruited with the opportunity of winning a prize, or recruited by companies which specialize in the delivery of motivated respondents from their individual 'panels.' The former, panelists who can win a prize, are motivated by the prize. The latter, panelists from a panel, are motivated to participate because they receive points towards purchase of a desired item. In virtually all experiences with Mind Genomics, working with a motivated panel is far better than relying on the goodwill of people who have no motivation. The desire to get thousands of respondents, therefore, from social media, is a misplaced desire. The study will never complete with the required number of respondents.

Welcome to our survey on Preserving Reasonably Priced Energy Supply. We need your help to prepare a comprehensive plan that identifies your needs.

We all know that energy is important, and we all want Affordable Reliable Electricity. Conservation and energy management remains the best defense against rising prices.

Please help us evaluate our energy resources and the action we can take to maximize the region's energy supply. Together we can keep our prices down, and support economic and demographic growth. Your input will also help us to provide information to welcome renewable energy suppliers and efficiency entrepreneurs to invest in our community.

You will read different scenarios about energy and the future. Don't worry about repeating yourself. All the scenarios are different! For each scenario please answer the following question.

**How comfortable does this paragraph make you feel about our future?**  
1= Very uncomfortable ...9 = Very comfortable

This survey will take approximately 10 minutes.  
You will be entered in a cash prize drawing for \$100 first prize and \$50 for 2<sup>nd</sup> and 3<sup>rd</sup> prize. You must complete the survey to be entered.

As long as you do not close out of the program you may take as long as you wish to complete the survey. This is not a test. We are looking for your "HONEST OPINIONS" and experiences.

Thank you for your participation in our ENERGY survey. Please click the '>' button below to continue.

**Figure 3:** Example of the orientation page, detailing what the project is about, what the respondent is expected to do, and the reassurance that all vignettes are different from each other.

5. Who participates in these studies - what emerged from this project. At the end of the evaluations is a so-called classification questionnaire, which asks a number of questions to further understand the respondent. The understanding comes from questions about who the respondent IS (geo-demographics, such as age), what the respondent DOES (e.g., how much per month in heating bills does the respondent pay), and what the respondent BELIEVES (e.g., how concerned is the respondent about energy prices.)

These classification questions give an overview of the composition of the respondent groups. The classification questions can be used to create homogeneous groups of people with respect to a specific criterion (e.g., Gender). That group can be analyzed in terms of the pattern of responses to the different elements. Table 2 shows the modal panel, the typical respondent in the study.

Participants were between the ages of 40-59.
City and Rural communities were largely represented.
Participants tended to be single-family dwellers with an average household of 1-2 adult members between the ages of 20-64.
72% of the total respondents were female.
Of 54% were employed, the job most reported was Miscellaneous and Homemakers with a median income of \$35,000.
In terms of participants self-stated pattern of energy use and attitudes towards conservation the highest energy consumption was 'Natural gas'.
The highest reported electrical, oil and gas bill sector was \$100- \$149.
Most reported a conventional furnace, however, 45% were not sure how to describe their furnace.

**Table 2:** The 'Modal' or typical respondents from the Mind Genomics study on mind-sets about renewable energy.

6. Analyzing the data to identify what elements drive positive feelings about the energy future. The respondents rated each of the vignettes on the 9-point scale about 'How comfortable does this paragraph make you feel about our energy future?' The scale is known as a Likert or category scale, with anchors on the top and the bottom scale points to help the respondents. Most researchers in the world of marketing research and political polling, from which the Mind Genomics efforts began, work with binary scales. Managers and readers alike understand the notion of 'No' and 'Yes.' When given a scale, they ask for the meaning of the different scale points.

In light of the ease with which binary data is understood and accepted, we transform the scale into two regions. Ratings of 1-6 are coded 0, to denote low confidence in the future, at least for this particular study on confidence in the future of energy. Ratings of 7-9 are coded as 100 to denote high confidence in the future, again at least for this particular study. A small random number (<10-5) is added to the transformed numbers. The random number has virtually no effect on the results, but enables the OLS (ordinary least-squares) regression to 'work' at the level of each individual respondent.

Parenthetical note: The particular transformation of the Likert Scale to the binary scale used here has been done, by convention, since 1986, or 31 years. In some cases, especially countries which routinely up-rate the vignettes, such as Mexico and the Philippines, the transformation is 1-7 → 0 and 8-9 → 100. For other topics, one may invert the scale, transforming 1-3 to 100, and 4-9 to 0.

We use OLS on a respondent by respondent basis. We create a simple linear model of the form: Binary Rating =  $k_0 + k_1(A1) + k_2(A2) \dots k_{20}(D5)$ .

Each respondent generates a separate model or equation. We then average the corresponding parameters across all respondents for a specific group, whether that group be Total Panel (all 228 respondents).

## Results

The results for the total panel appear in Table 3. It is worth noting here that the respondent is incapable of 'Gaming' the system to provide so-called politically correct answers. The vignettes are compounds, so it becomes virtually impossible to do anything other than give one's own 'instinctive, immediate, i.e., so-called 'Gut' reaction.

Total Panel-base size of 228 respondents	
Additive constant-baseline = estimated proportion of respondents who would feel 'comfortable about our energy future' ....in the absence of elements to describe plans for that future'	26

	Coefficients-incremental (positive) or decremental (negative) percent of respondents who would feel 'comfortable about our energy future' were the element to be incorporated into the vignette. Add the coefficient to the Additive Constant to see the effect	
D4	Gradually transition to using 80% renewable energy and 20 % conventional energy	7
D3	Gradually transition to using 50% renewable energy in two years	4
D5	Implement five- year plan for gradual increased use of renewable energy	3
C5	Our first- year service plan, "you don't save, you don't pay"	3
C1	Free energy conservation evaluation... personal in-home/in-business	1
D1	Gradually transition to using 10% renewable energy services in one year	0
C3	Free yearly re-evaluation of all energy service plans	-1
D2	Gradually transition to using 20% renewable energy and 80% conventional energy	-1
C2	Service by highly trained and experienced technicians	-2
C4	Several choices of renewable energy plans	-2
A2	Inadequate supply of electricity	-2
A5	Energy prices exceeding NYS and National averages	-2
A4	Business relocating to other regions due to high energy cost	-3
A3	Closing Indian Point power station	-4
A1	Rising energy prices	-6
B5	Quarterly separate renewable energy development bill (based on 5% of property value assessment), to create new service programs!	-8
B4	Year-end separate renewable energy development bill (based on 10% of property value assessment), to create new service programs!	-9
B1	Increase county tax by 10% for renewable energy- development services	-11
B3	Increase county tax by 20% for renewable energy- development services	-12
B2	Increase county tax by 15% for renewable energy- development services	-13

Table 3: How the average respondent reacts to the notion of energy confidence, and specific aspects of that notion. The table shows the first step in identifying the Mind Genome, and the different 'Mind Alleles' of

the topic of confidence about 'Our Energy Future'.

1. Dividing respondents by who they ARE, what they BELIEVE, and introducing new-to-the- world mind-sets. Each respondent can be classified into different groups, depending upon what the respondent answered in the classification questionnaire, completed at the end of the evaluation of the test vignettes, i.e., after the 'experiment' [8,9]. Since we create an individual model, we can average the corresponding parameters of the individual models for all respondents belonging to a pre-defined group.

We get a sense of the different groups, and how they feel about their energy future, from the array of numbers in Table 4. To make the data more accessible, we present a limited number of subgroups, including gender, age, concern about the environment, concern about energy prices, and at the end, two new groups, our mind-sets or mental alleles for this topic of concern about our energy future. The mind-sets will be discussed in depth in the next section. For Table 4, it is sufficient to introduce them to highlight an important comparison and effect, one seen in project after project with Mind Genomics.

Table 4 shows the base size, the additive constant, and then the 20 elements sorted from high to low, based upon the average coefficient from the Total Panel. We highlight all elements whose coefficients exceed +9.51 or whose coefficients are less than -9.51.

It is clear from Table 4 that the 228 respondents do not really agree on the elements which drive a positive feeling of our society's energy future, but do agree on the elements which drive a negative feeling of our society's energy future.

a. The additive constant is low, 26. In the absence of elements, only 26% of the respondents feel comfortable about 'our,' i.e., society's energy future. It is the elements which must do the work. The basic feeling is discomfort and negativity.

b. The big numbers are not the top, i.e., the elements which drive a sense of confidence. Rather, the big numbers are the bottom, the negative numbers, i.e., the elements which drive a sense of lack of confidence in the energy future.

c. Men and women differ, both in their additive constants (men's average additive constant is higher) and in the elements. Men feel basically more comfortable about our energy future than do women (additive constant = 42 for men, 20 for women). The elements different as well, but the pattern of differences is not clear. We can make no easy generalization about the nature of the differences between men and women with respect to their feeling about our energy future.

d. Age makes little difference in the patterns

e. Concern about the environment and concern about energy prices also do not make much of a difference

f. It is important to note that whereas there ARE some differences in element value across complementary groups, the patterns of such differences are not clear. One could craft a 'Story,' were one to be so inclined, but the point of view of Mind Genomics is that probably differences of a profound nature exist, but those differences must be extracted analytically. Once extracted, these differences become self-evident, meaningful, and useful. In other words, stories about data simply do not suffice in Mind Genomics. The data must convince, and not an intellectual 'Kabuki dance' of interpretation, of a post-hoc nature. There is a name for this story telling-apophenia, seeing patterns where they don't really exist. Mind Genomics avoids apophenia.

		Total Sample	Gender -Male	Gender -Female	Age < 50	Age 50+	Concern about environment -extreme	Concern about environment -somewhat	Concerned about energy price - extreme	Concerned about energy prices -somewhat	Mind-set 1 of 2	Mind-set 2 of 2
	Base Size	228	62	166	116	112	94	129	175	51	158	70
	Additive constant (base-line)	26	42	20	26	26	27	25	27	23	35	6
D4	Gradually transition to using 80% renewable energy and 20 % conventional energy	7	3	9	7	7	9	7	8	6	4	14
D3	Gradually transition to using 50% renewable energy in two years	4	-1	6	5	2	9	0	7	-5	3	5
D5	Implement five-year plan for gradual increased use of renewable energy	3	-1	4	4	2	6	1	3	2	1	7

C5	Our first-year service plan, “you don’t save, you don’t pay”	3	1	4	4	2	2	4	1	10	3	2
C1	Free energy conservation evaluation... personal in-home/in-business	1	-3	2	0	2	0	2	0	5	2	-3
D1	Gradually transition to using 10% renewable energy services in one year	0	-2	1	2	-2	0	0	-1	3	-1	3
C3	Free yearly re-evaluation of all energy service plans	-1	-6	1	0	-1	-1	0	-3	6	0	-2
D2	Gradually transition to using 20% renewable energy and 80% conventional energy	-1	-5	0	-1	-2	-1	-3	-3	3	-3	3

C2	Service by highly trained and experienced technicians	-2	-8	1	-2	-1	-1	-1	-3	1	2	-9
C4	Several choices of renewable energy plans	-2	-7	0	-1	-2	-2	-1	-3	3	1	-7
A2	Inadequate supply of electricity	-2	-1	-3	-3	-2	-4	-1	-3	2	-3	-1
A5	Energy prices exceeding NYS and National averages	-2	-8	0	-3	-1	-4	-1	-2	-2	-3	-2
A4	Business relocating to other regions due to high energy cost	-3	-6	-2	-2	-4	-6	-1	-4	-1	-5	1
A3	Closing Indian Point power station	-4	-6	-3	-4	-4	-4	-4	-4	-5	-5	-1
A1	Rising energy prices	-6	-11	-3	-5	-6	-8	-3	-7	-3	-6	-4

B5	Quarterly separate renewable energy development bill (based on 5% of property value assessment), to create new service programs!	-8	-12	-6	-5	-10	-3	-11	-8	-5	-17	14
B4	Year-end separate renewable energy development bill (based on 10% of property value assessment), to create new service programs!	-9	-14	-8	-7	-11	-7	-11	-9	-12	-21	17
B1	Increase county tax by 10% for renewable energy-development services	-11	-15	-10	-10	-12	-6	-15	-12	-11	-23	15

B3	Increase county tax by 20% for renewable energy-development services	-12	-15	-11	-12	-12	-9	-13	-13	-9	-24	14
B2	Increase county tax by 15% for renewable energy-development services	-13	-18	-11	-11	-15	-11	-15	-14	-11	-27	18

**Table 4:** How different groups of individuals respond to the 20 elements from the energy study. All groups except the mind-set segments come from the self-profiling classification that respondents completed after evaluating the vignette. The Mind-Set segments come from clustering the coefficients of the 20 elements to define two different groups, alleles, which are parsimonious (two groups), and which are interpretable (their average coefficients ‘Tell A Simple Story’).

2. New-to-the-world mind-sets-alleles of the mental genome of ‘Confidence in our future.’ Our data for each respondent comprises a set of 20 coefficients from the OLS regression, and an additive constant. We use the statistical method of cluster analysis to divide our 228 respondents into groups, based upon the pattern of coefficients. The clustering program takes no account of the meaning of the 20 elements, but rather tries to minimize the variability within a cluster or group of respondents, and maximize the difference between the centroids of the groups, i.e., the averages of the 20 elements. In other words, the clustering program puts the 228 people into two groups so the groups are relatively homogeneous, but the averages of the groups are as different as possible. Furthermore, the groups, our mind-set segments, or mental alleles, must be parsimonious (fewer are better), and most of all, interpretable (they should tell a simple story) [10].

Table 4 compared the coefficients from the various subgroups. The subgroups agreed in the negatives, specifically increasing taxes, but did not really show many elements which were positives, i.e., which would lead to a better feeling about the energy future. Table 5 shows the stories emerging after the cluster analysis emerged with two mind-set segments, ‘alleles’ for this Mental Genome of our very limited topic, ‘Our Energy Future.’

The appropriate number of mind-sets, these ‘Mental alleles’ for a topic is simply as few as possible. The notion is parsimony. The perfect need not be the enemy of the good. The full set of 20 elements need not tell two clearly different stories for two mind-sets, i.e., two mental alleles, to be accepted. The mind-sets, our mental alleles, simply must tell a story. They do. One need only look at the strong performing elements for the two mind-sets.

		Total	Mind-Set 1	Mind-Set 2
	Base Size	228	158	70
	Additive constant (baseline)	26	35	6
	Mind-Set 1 – Gradualists - Positives			
D4	Gradually transition to using 80% renewable energy and 20 % conventional energy	7	4	14
C5	Our first-year service plan, “you don’t save, you don’t pay”	3	3	2
D3	Gradually transition to using 50% renewable energy in two years	4	3	5

C1	Free energy conservation evaluation...personal in-home/in-business	1	2	-3
	Mind-Set 1 – Gradualists - Negatives			
B4	Year-end separate renewable energy development bill (based on 10% of property value assessment), to create new service programs!	-9	-21	17
B1	Increase county tax by 10% for renewable energy development services	-11	-23	15
B3	Increase county tax by 20% for renewable energy development services	-12	-24	14
B2	Increase county tax by 15% for renewable energy development services	-13	-27	18
	Mind-Set 2 – Realists - Positives			
B2	Increase county tax by 15% for renewable energy development services	-13	-27	18
B4	Year-end separate renewable energy development bill (based on 10% of property value assessment), to create new service programs!	-9	-21	17
B1	Increase county tax by 10% for renewable energy- development services	-11	-23	15
D4	Gradually transition to using 80% renewable energy and 20 % conventional energy	7	4	14
	Mind-Set 2 – Realists - Negatives			
C1	Free energy conservation evaluation...personal in-home/in-business	1	2	-3
A1	Rising energy prices	-6	-6	-4
C4	Several choices of renewable energy plans	-2	1	-7
C2	Service by highly trained and experienced technicians	-2	2	-9

**Table 5:** Two mind-sets, i.e., alleles for the mental genome about feelings about ‘Our energy future.’ The table shows the strongest and the weakest performing elements for each mind-set. The names of the mind-sets are chosen by the researcher.

3. Identifying mental alleles in the general population. It is not sufficient to stop at discovering these new-to-the-world mind-sets for a topic, the alleles for that topic. For Mind Genomics to have use beyond simply a data reduction, academic tool which points out new ways of dividing people, Mind Genomics must provide us a way to discover these mental alleles, these mind-sets, in the general population, when we meet a new person. If, in fact, we can classify a NEW person as having a specific mind-set for a topic, then we have the opportunity to expand Mind Genomics beyond a descriptive science to a predictive science.

People do not walk around with a set of numbers showing their mental alleles, their membership in different mind-sets. For one, such a case would be impossible, since we can create a virtually infinity of topics of the human experience, simply by defining different aspects of behavior. In mathematics, we have what is called the Aleph Null infinity-a countable infinity of sets of such alleles, sets of mind-sets, each ‘Set’ pertaining to an aspect of

human perceptions, values, behaviors, respectively.

One mechanism by which the mind-sets, the alleles, for a topic may be discovered, comes from post-processing of the data from which the mind-sets were discovered. We know the elements which are high and low for each mind-set. We can construct a set of vignettes with the property that some vignettes strongly appeal to one mind-set, one allele, but turn off or fail to appeal at all to the other mind-set(s). With several of these, we can lay out the expected pattern of responses for people in both mind-sets (e.g., gradualists versus realists, for our study). A new person need only read the different vignettes, and rate each. The pattern of responses will immediately dictate the likely mind-set membership of this individual, or in the language of genomics, the likely mental allele of this person. Figure 4 shows a worked exercise. The benefit here is that one may now classify new people, based simply upon a quick intervention, a quick encounter with the action being rating three vignettes. Figure 4 shows a worked example.

<p>Business relocating to other regions due to high energy cost          Increase county tax by 15% for renewable energy development services          Our first year service plan, you do not save, you do not pay          Gradually transition to using 80% renewable energy and 20% conventional energy</p> <p><b>Please Select:</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> </table> <p><b>Next</b></p>	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	
<p>Closing Indian Point power station          Increase county tax by 10% for renewable energy development services          Free yearly re-evaluation of all energy service plans          Gradually transition to using 20% renewable energy and 80% conventional energy</p> <p><b>Please Select:</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> </table> <p><b>Next</b></p>	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	
<p>Rising energy prices          Increase county tax by 20% for renewable energy development services          Free energy conservation evaluation .. personal in-home/in-business          Implement five year plan for gradual increased use of renewable energy</p> <p><b>Please Select:</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td></tr> </table> <p><b>Next</b></p>	1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9	
<p><b>Thank you</b>          You belong to the Second Mindset. REALISTS, who would support some county tax increase, and gradually transition but refuse rising energy prices.  <b>Thanks for taking the survey!</b></p>									

**Figure 4:** A worked example of the PVI, the personal viewpoint identifier, to determine the mind-set or mental allele for a topic held by a new person, one having just been invited to participate a study.

The implications of discovering in a population the specific mind-sets (mental alleles) Those involved in genomics are interested in the relation between the underlying genomic composition of a 'thing' such as a plant, and the way that genomic composition expresses itself in the physical form or behavior of the object. With Mind Genomics, we move down that path of understanding the deep relation between the mind and behavior, but with several added aspects.

1. The specific topic, the mental genome for the topic, is itself interesting to science. The data alone, first for the total panel, and then for the mind-set, the mental alleles, provide a new, unifying structure for the science of human behavior. In effect, we map attitudes as a cartographer would, but from the strategy adopted by a pointillist artist. We begin at the micro-

level, and aggregate knowledge by dissecting attitudes, even at the micro-level, identifying the elements of those attitudes, and then discovering the genome and its alleles.

2. Virtually any topic can be dissected in this manner, as long as the topic is one where the 'mind of man (or women) is the measure of all things.'
3. The discovery of the mind-sets, the mental alleles, provides a way to uncover the deep structure of the specific topic, a structure that might have been guessed at, but not operationally revealed.
4. The relative simplicity of the method and the ease by which millions of people can then be 'mind-typed' for any topic after the research suggests a direction to look at how these mind-

sets co-vary with other aspects of the person, such as background, experience, current health, current economic status, current social status, and so forth.

5. Beyond the simple single mind-type, the one genome with its alleles, is the possibility of doing dozens of these experiments, thoroughly exploring a topic such as healthful foods, or reactions to socially negative issues such as radicalization. Rather than doing one study, e.g., about feelings of 'Our energy future' among residents of lower New York State, it becomes possible to do dozens of studies in a related area, discover the genomes and alleles for each mental genome, and create the appropriate typing tool. The piece de resistance, afterwards, i.e., the so-called 'icing on the cake,' would be the creation of the dozens of associated typing tools, the typing of hundreds of thousands, if not millions of people, the simultaneous typing of their genome through a service such as '23 and ME,' and a completed, extensive history of the person.
6. The foregoing triple, would then be used to
  - a. Create a knowledge base of the human mind through these disciplined experiments. Each experiment would focus on a particular aspect of a person's life, whether the aspect be preferences among objects or experiences, or even ideas of a philosophical and social nature.
  - b. Discover the mind-sets from each experiment, i.e., the alleles from each mental genome
  - c. Discover linkages between the pattern of one's mental allele's, one's actual gene alleles, one's attitudes, and one's behaviors. The effort would create an entirely new science of the mind, and a new, integrated approach to understanding people and society.
  - d. The result is feasible, and indeed extremely cost-effective, with each study costing no more than \$1,500 in today's (August 2017) out of pocket costs for 250 respondents, who are straightforward, easy to find. It is tempting to imagine just how much can be done, say for the world of medicine, with 20 of these studies, focusing on 20 touchpoints of the medical experience, from discomfort to disease to discharge from the hospital.

## Conclusion

The present paper introduces Mind Genomics, a tool which is able to uncover the subconscious opinion of people, similarly to genomic analysis of biological samples. This subconscious information is later used to describe subgroups, and the possible behavior of these subgroups can be well predicted.

The notion of what 'Drives interest' in a particular product or service is the normative notion, the problem that everyone wants

to solve. The reason for the popularity of that focus is simple. People live in today, and focus on WHAT is important, right now. The 'NOW' of today is the specific problem to be solved, whether that be how to have a better hospital experience, how to sell shoes, or what should be on the label of a product.

In the world of genomics, the ideal is to be able to sequence the mind in a topic area, such as health, create the typing tool, and then sequence the 'health-experience mind' of many people, with the goal of using the proper messaging to improve prevention, increase compliance and produce a far better set of medical outcomes. This can be said for education, and indeed for so many topics, such as healthy eating, and more effective, happier and productive work situations.

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