

# BiPSA: From Controversy to Consensus

## *Binarized Opinions Neurally Integrated*

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*Abstract:* Our society is facing a host of controversial issues that tend to remain at an impasse, despite the fact that urgent action may be needed. e.g.: Global Warming, Peak Oil, Radical Islam. Oftentimes the impasse is resolved by a last minute, panic driven executive order that is overly likely to be a costly mistake. BiPSA is a proposed mechanism designed to bring to bear the wisdom of the community of experts and that of the community of stakeholders, and generate the most credible opinion on that disturbing controversy. BiPSA is results-neutral. Its operator does not impact the outcome: the community is the source, the master, and the benefactor as well as the victim, as the case may be, of its own integrated opinion. BiPSA incorporates the opinions of all the members of the community, but the community determines how much impact each opinion source will have. BiPSA breaks down each controversy into a cascade of binary questions, and the BiPSA respondents are denied the luxury of hedging, being forced into binary clarity, qualified only by a measure of confidence in one's own opinion. The BiPSA opinions are integrated through an outcome-neutral neural algorithm that improves with use, thereby increasing the credibility of the BiPSA result at each successive round. BiPSA is not a magic wand casting everyone into the same opinion (ideal consensus). And it is not a negotiating tool per-se to arrive at a give-and-take compromise over the lingering disagreements. But it is a tool to extract the fair representation of the opinion of the community as a whole, and there lies its merit.

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## 1. Introduction

It is not infrequent that issues of great human significance are plagued by controversy and diverse opinions. Proponents of un-ignorable credentials position themselves across each other, sending the matter into a state of confusion and impasse. This happens every day in our court rooms, where judges and juries resolve civil and criminal controversies. Such a resolution is practical and necessary: a representative of society is given the authority to reduce the diversity into unity. The commander in chief will end a war-and-peace controversy by giving marching orders to the troops. Health authorities will issue emergency quarantine orders, ending a controversy regarding a prospective pandemic. In all these cases one or few, armed with public authority, banish the uncertainty with an executive order.

It does not take a long study of history to conclude that this methodology is severely flawed. Innocent people were wrongly judged; unnecessary wars raged for years of needless, pointless bloodbath; worthy human undertakings were closed down for no good reason; precautionary steps to face a pending calamity were not taken on time -- all attributed to a misguided decision by one or few.

So the question arises: can we come up with a better paradigm? Can we handle controversy differently?

Examining this question from the Olympus of theoretical considerations one comes up with the exquisite notion of consensus. Would it not be nice to process every controversy into consensus? If we all agree on the situation and the best course of action, then we don't need an executive dictate for us to accept under protest. And if the consensus is wrong (and this happens) then at least we have no dictator to blame, no authority to rebel against. It's us -- the community as a whole -- that made the mistake, and it's only fair that the community will pay the price.

Taking on the notion of consensus we can distinguish certain degrees: pure, compromised, and formalized.

"Pure Consensus" is the ideal state. The once controversy about whether the earth is round or flat has resolved itself into a "pure consensus": virtually everyone agrees on the answer. "Compromised consensus" is what Congress does, balancing opposing interests into a law that everyone that voted for it would like it to be somewhat different, but prefers it to no law at all. "Formalized consensus" is exemplified by US presidential elections. Supporters of the losing candidate may vehemently oppose the president elect, but accept his authority since it was established in a process they signed up for.

A pure consensus is most desirable, but it may take a very long time to achieve. A compromised consensus is better than a formalized one, but it requires an existing framework (like the constitution, or corporate by-laws), and its main shortcoming is the fact that it's generated through force: the powerful "twists the arms" of the weak. Many human controversies are not fit for a compromised consensus. For example it makes little sense for Congress to legislate a resolution to the peak-oil controversy, or to the controversy about warming of the planet.

So, in reality, we are left with the formalized consensus: a general paradigm to handle important human controversies. It's of special importance for controversies that require action on one, or on either side of the issue. It would be nice to keep pumping oil until reality will resolve the controversy of peak oil, only that this "wait and see" attitude might catapult us into World-War III.

The object of this treatise is to describe a universal methodology to achieve formalized consensus for any issue of human importance.

## 2. Definitions

We wish to define the following concepts:

- **Community of Reference (COR)**
- **Issue of Controversy (IOC) - subjective and objective**
- **Consequences of issue mismanagement**
- **issue binarization**
- **opinion source, voter**
- **qualified binary opinion/vote**
- **integrated opinion**
- **reality check**
- **relevant feedback**
- **the BiPSA operator**

**Community of Reference:** this is the set of all the individuals that are either stakeholders for the controversy at hand, and/or have relevant expertise for the same. The community of reference may be as large as a nation or larger, to handle large scale and profound controversies, or the community of reference may be as small as a township deciding whether to spend their tax dollars on a storm shelter. BiPSA would work for any group of two or more, helping with small scale controversies. In some cases the people whose interest is affected by the controversy are not the ones with proper expertise to solve it, but in other cases they may be one and the same. The BiPSA idea is that either group has a say. BiPSA is an uncompromising outreach. If you are a stakeholder, or if you have relevant knowledge, we want to hear from you, and incorporate your input into the final word. Experts will contribute their understanding of the issue, and stakeholders without expertise will be asked to rank order the various disciplines of relevance. So, if a small town is debating a proposal to build a new dam on the near-by river then the three types of experts may be civil engineers, environmentalists, and financial mavens, but the

community at large will be asked to rank order these disciplines, and say, for instance that what the environmentalists say should count more than the word of the CPA -- or vice versa, or perhaps all three disciplines should count the same. This determination is carried out by the stakeholders who may or may not have any expertise in any of these disciplines. One thing is for sure, the BiPSA operator is not setting up any parameters that are not outcome-neutral.

The issue of controversy is by definition one for which the community of reference has disagreement. Moreover the issue should be one for which the community of stakeholders do not have the luxury to (1) not resolve it, and (2) to wait for pure or compromised consensus. Such controversies need a solution that will enjoy formalized consensus as described in the introduction.

We distinguish between subjective and objective controversies. Subjective cases are those where there is no external determinator to validate the community say, while an objective controversy will eventually stand trial in the courtroom of reality. The pro-choice, pro-life controversy is an example of a subjective case. We don't expect reality to show us what is the right way. The controversy about global warming -- whether it occurs or not, is an objective case. The measured temperatures of the planet will either validate or invalidate the formalized compromise of world community. Some cases are indeterminate. Is the planet warming up because of man made influence, or are there natural forces in play, regardless of what man does or does not? This controversy may one day find a clear and convincing evidence one way or the other, but then again, it might not.

BiPSA comes to its full force with objective controversies. The main reason is that the experts who are prompted to express their opinion in binary clarity will be fully aware that their say will be subject to reality check. Absent BiPSA the same experts express their opinions in hedged memoranda that are designed to safeguard their reputation whatever reality comes up with. This latitude disappears with the binary clarity of the BiPSA answer. As a result experts are very careful in expressing their opinion in the BiPSA framework.

The BiPSA operation is an extra effort in organization, administration, technology and promotion, and hence it makes no sense to carry it out over controversies that are not sufficiently significant. Significance can be judged by the harm done in case of mismanagement. Harm can be expected on both sides of the issue, or only on one. Harm may be direct, or indirect, it may be loss of money, or it may be loss of opportunity. The greater the price of mismanagement, the more attractive BiPSA. The reason is twofold: BiPSA has the best chance to come up with the right answer, and if not then it's best to pay the price if the community as a whole says it's our fault, there is no one to blame.

Many human controversies are binary in nature: does the planet warm up or not? Is abortion acceptable or not? Is social morality decaying or not? But others are more complex: how to respond to an economic depression? What to do with illegal immigration? BiPSA hinges on the concept that every issue and every controversy,

however complex, however cloudy, can be expressed as a series of binary issues. This expression is referred to as issue binarization.

BiPSA is a community based answering mechanism to a clear binary question. The answer comes from opinion sources, or voters. These sources are nominally human when it comes to human controversies, but in general the opinion sources may be non-human. For example, BiPSA is applied as a computer security device. When people log in to their bank account the question of the bank is are they who they say they are? (yes/no?). Every action, every parameter of the log in process: what they type, when, how long they hesitate, etc. is regarded as an opinion source on that binary question, and BiPSA integrates these votes to a summary conclusion on whether to allow this remote user his request for online access.

The BiPSA opinion is a binary choice qualified with a measure of source confidence in his, her, or its opinion: how sure are you that your take on the issue is correct?

An arithmetic mean is a single number that represents the set of numbers that were processed to calculate it, similarly with BiPSA. A set of BiPSA votes is processed to generate a single vote that represents the set. That vote is also binary qualified with a measure of confidence. Because the output of the BiPSA integration is a normal BiPSA opinion, it is possible to feed that output to a subsequent integration unit, and to do the same with the new output. This allows one to configure a complex integration network that ends up with a single BiPSA output. The BiPSA integration algorithm was designed to fairly represent the input votes.

Oftentimes a controversy that rages today may be unequivocally resolved tomorrow. Would the stock market exceed a given threshold by the end of the year? When the year ends, the issue is downgraded from its status of being a controversy. Such controversies are said to be associated with a reality-check that honors the correct opinion sources, and shames the rest. It especially honors or shames as the case may be, those voters who expressed their opinion with the highest measure of confidence.

Reality check is a powerful mechanism that modifies the impact level of each voter. Alas, if the check comes when the issue is no longer a controversy then it's a bit too late. To apply this mechanism, it is advisable to run BiPSA over similar controversies with a shorter time span. The reality check from these cases would be applied to integrating the main, long-term controversy.

BiPSA is operated by a neutral administrator that is focused on a proper execution of the BiPSA framework. The BiPSA operator is analogous, in a way, to a judge in a jury trial: keeping the procedures straight, but having no say on the question of the day.

### **3. Principles**

The underlying principle for "BiPSA: Controversy to Consensus" is the idea that (1)

nobody, however brilliant, for the long run, is any match for the wisdom of the relevant community. For any individual case, or for a limited time, there may arise a periodic "genius" with wisdom that exceeds the combined smarts of the community of reference, but for sufficiently long stretches, the wisdom of the community prevails.

When a community faces an issue of significance, where the consequences of mismanagement are dire or severe, then as a matter of principle (2) it is best to base the course of action on the opinion of the community as a whole, rather than on the decision of a single, or few, decision makers. If the community ill-decides, the community has no one to blame, and it will more willingly share the blame and pay the consequences.

These two principles suggest the question: how to bring the wisdom of the community to bear? In its raw shape the wisdom of the community is expressed by the collection of opinions of its members. If every member of the community shares the same opinion as the others, then this opinion naturally is the opinion of the community as a whole. But this is the trivial, and uncommon case. When the members of the community do not completely agree, it becomes a challenge to express the opinion of the community.

Normally opinions are expressed with vagueness. Experts tend to hedge, counselors mind their reputation and use doubletalk to defend against embarrassment. Others don't think so clearly and without mal-intent express their thoughts with lack of clarity. It is important therefore to develop a mechanism that would wash away this persisting opinion vagueness. Here we come to the first operational principle of "BiPSA Controversy to Conclusion": (3) express every issue of controversy as a cascade of binary questions. Much as the normal decimal numbers can be expressed in a binary way, (using zero and ones only), so it's possible to express any issue of controversy as a series of binary questions such that by properly answering all of them, the issue is completely resolved. This principle is based on the theorem that says that it is possible to do so. The theorem can be readily proven as follows. Any issue of controversy can be regarded with the following question: *will a certain, well defined, course of action resolve it?* The answer is binary, it's either yes, or no. If 'yes' then the issue is resolved through a binary answer. If the answer is 'no' then a similar question can be asked with respect to a different course of action, and a third, and so on. The binary answers would be "no", "no", "no", until at some point the answer would be 'yes' and the issue is resolved. This applies to any issue of controversy, regardless of its particular nature. Of course this approach is not very efficient, but it proves the theorem. To illustrate, consider a project for which there is a raging controversy as to its cost. Everyone, it seems, has a different estimate in mind. This issue can be handled as above through the series of questions: *will it cost 1\$ to build the thing?* If yes, the issue is resolved. If the answer is no, then the next question will be, *would it cost 2\$ to built it, then 3\$, etc. until one reaches a certain figure of \$x for which the binary answer is 'yes'.* A more efficient way is to start with a large sum, \$L, and ask: *"can the project be built for less than \$L?"* if L is sufficiently large the answer would be 'yes'. Then the next question will be: *"Can the project be built for 0.5L\$ or less?"* Whatever the answer, the desired figure is known within an interval of 0.5L\$. This interval is then cut in half, and the next question is, *would the estimate fall in the lower half or in the higher half?* This halving-the-interval procedure will continue until one

narrows down the estimate to a small interval as desired. This is more efficient than the former by a large ratio of  $x/\log(x)$ .

Once an issue is "binarized" it appears as a series of binary questions for which in the trivial case, all members of the community of reference are responding likewise. In that case the community answer is trivial. In the more common case some members pick one answer, and the rest pick the opposite answer. The question of interest now is how to integrate the community opinions to reflect the community as a whole?

One trivial answer is a straight count of the two options, and the more popular one carries the day. This is what happens in an election with two opposing candidates. For this method to be justified it is necessary to assume that each voter, or opinion source is as worthy as another. While in the case of say, US presidential election, there is no reason to believe that a physician has a better take on the issue than a barber, and so straight count of the votes is justified, in other issues of controversy this assumption does not hold. "Is it healthy to drink more than four cups of coffee a day?" This is an objective issue of controversy for which most would agree that a physician's opinion should count more than a barber's. This leads us to the principle of opinion integration (4) individual binary opinions should be integrated such that more worthy votes would count more than less worthy ones.

This poses the question: how to determine the worth of a given binary opinion? This is resolved with the principle of worth determination, (5):

The impact of binary votes on an issue of controversy will be determined on the basis of three factors: 1. the confidence of the voter in his/her own opinion; 2. the a-priori credentials of the voter with respect to the issue of controversy; 3. the historic performance of the voter in similar BiPSA integration cases.

These are the key principles of "BiPSA: Controversy to Consensus". We can now define the essentials of the procedure.

#### **4. Essentials of The BiPSA Procedure**

The essential BiPSA procedure is comprised of the following elements:

- **1. identification of the environment.**
- **2. opinion extraction**
- **3. opinion integration**
- **4. feedback**

In its totality the BiPSA procedure will collect the individual opinions of the members of the community of reference with respect to a given issue of controversy, and generate the integrated opinion of the community as a whole, producing a formalized community consensus for the issue at hand.

#### 4.1. Identification of The Environment

The environment is comprised of a well defined community of reference, and a significant issue of controversy. Issues of controversy which are not very significant do not warrant the BiPSA effort.

The issue of controversy will then be defined as a cascade of binary questions, and each binary question will undergo a 'BiPSA round' defined as a procedure of opinion extraction and opinion integration.

#### 4.2. Opinion Extraction

This step is comprised of reaching out to the members of the society of reference, and prompting them to offer their binary opinion along with an indication of their own confidence in their stated opinion. Nominally, (with some exceptions), the BiPSA vote is on record, and a fact ready for future review and analysis.

The BiPSA methodology uses integers to express qualified binary opinions. Positive integers express a 'yes' to the binary answer, and negative integers express a 'no'. The absolute value of the integer reflects the confidence of the voter in his or her own opinion. Thus a "+3" represents a positive answer with a measure of confidence greater than a peer's opinion expressed as "+2".

Nominally, the binary opinions are expressed through the nine options:

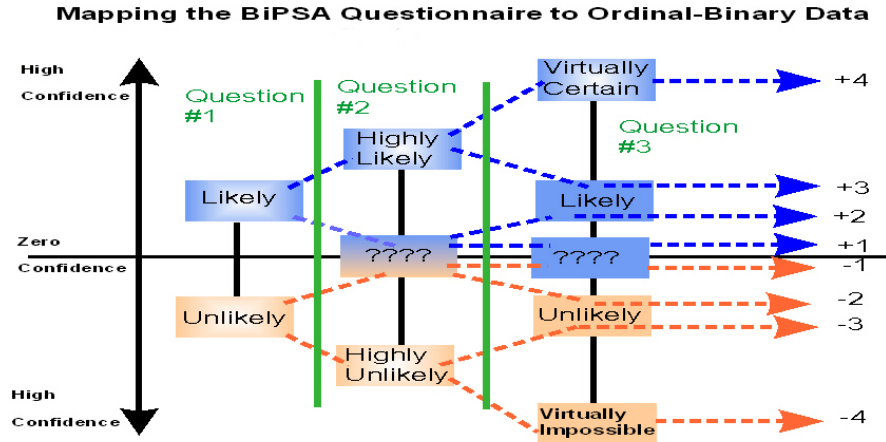
-4, -3, -2, -1, 0, +1, +2, +3, +4

where "0" reflects indecision.

These options are nominally computed from answers given by voters to the following three multiple choice questions:

Please Vote:	
<b>The above described scenario is more likely</b>	<input type="radio"/> TO HAPPEN ..... <input type="radio"/> NOT TO HAPPEN
<b>The above described scenario is</b>	<input type="radio"/> HIGHLY LIKELY ..... <input type="radio"/> HIGHLY UNLIKELY <input type="radio"/> NONE OF THE ABOVE
<b>The above described scenario is</b>	<input type="radio"/> VIRTUALLY CERTAIN ..... <input type="radio"/> LIKELY <input type="radio"/> VIRTUALLY IMPOSSIBLE ..... <input type="radio"/> UNLIKELY <input type="radio"/> NONE OF THE ABOVE

Using the following mapping:

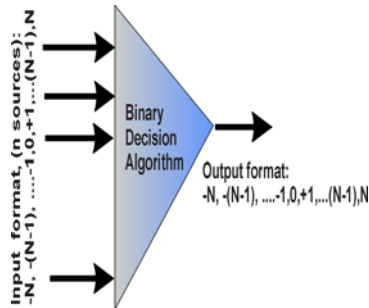


Question #1 requires a selection between two options.  
 Question #2 requires a selection among three options.  
 Question #3 requires a selection among five options.  
 There are eight logical combinations, each is mapped to a different ordinal-binary value.

When done, the BiPSA operator has extracted n opinions, each represented by an integer  $\{-4:+4\}$ .

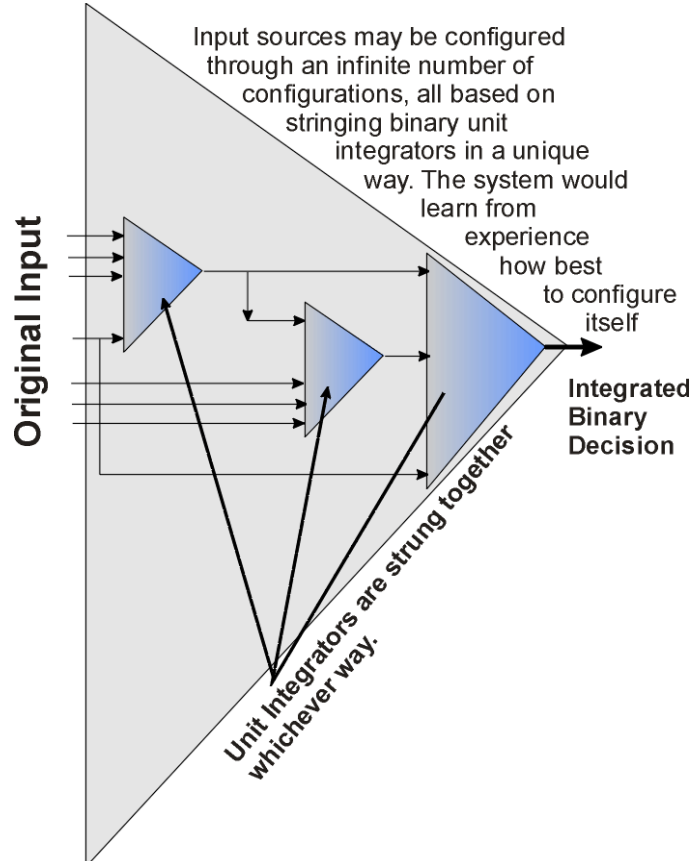
### 4.3. Opinion Integration

The BiPSA integration is a process where some n individual binary opinions are reduced to a single opinion of the same format:  $\{-4:+4\}$ .



The integration is accomplished through a neural network comprised of BiPSA unit integrators: .

The unit integrators are configured according to:



1. *a-priori voters' credentials.*
2. *evolving relevant feedback*

These notions are explained below.

**4.3.1. the BiPSA unit integrator:** The BiPSA unit integrator takes in any number,  $m$ , of BiPSA votes each in the form of  $\{-4:+4\}$ , and outputs a single vote in the same format. The order of the input votes is immaterial. Their weights (impacts) are the same. The exact unit integration algorithm is a bit too involved for here, but a few sample cases will convey the spirit of the integration:

In the following examples the input variables are comma separated within square brackets at the right side of the BiPSA equation, and the integrated value is indicated on the left side.

$$N = [N]_{\text{BiPSA}}$$

$$N = [N, N, N, N]_{\text{BiPSA}}$$

$$0 = [N, -N]_{\text{BiPSA}}$$

$$[K, L, M, N]_{\text{BiPSA}} = [N, M, L, K]_{\text{BiPSA}}$$

$$[-N, -M, -L, -K]_{\text{BiPSA}} = -[N, M, L, K]_{\text{BiPSA}}$$

$$1 = [4, 1, -2, -1]_{\text{BiPSA}}$$

$$1 = [4, 1, -2, -1, -2, 1]_{\text{BiPSA}}$$

Where  $K, L, M, N$  are BiPSA values in the form  $\{-4:+4\}$ .

**4.3.2. A-Priori Voters' Credentials:** Based on the issue of controversy, the BiPSA operator prepares a list of disciplines of knowledge that bear relevance to the issue at hand.

Based on this list, two steps are called for:

1. ranking the disciplines of relevance
2. determining voters' credentials with respect to same disciplines.

These two steps are elaborated on below.

**4.3.2.1. Ranking The Disciplines Of Relevance:** Each member of the community of reference should be given the opportunity to express his or her opinion on the ranking of the disciplines. These opinions are integrated by allotting equal weight to all the voters.

The exact procedure for translating the ranking opinions to a summary ranking is not essential to this presentation. What is important is the fact that all the members of the community are encouraged to express their ranking opinion, and that all opinions count the same.

Voters may use the BiPSA ranking form on the Internet to express their opinion:  
<http://www.bipsa.com/knoweigh.htm>

This step insures that the community as a whole, without discrimination, determines which discipline of knowledge should count more and which less when the community votes are integrated.

**4.3.2.2. Determining Voters' Credentials:** Each voter will indicate her self evaluation with respect to each discipline of relevance. This indication will be expressed through natural numbers: 1 - represents low level of expertise, 2- medium level, 3 - high level, and 4 - the definitive level (rare). This levels of expertise may then be verified by some standard verification procedure, which is not essential to this procedure.

When complete, each opinion source (voter) will be characterized by a string of numbers, saying for instance that this voter has a level 2- of expertise in history, and a level 3 in biology, and 1 in physics. If the voter has only negligible expertise in a given discipline, this is indicated by a zero.

#### **4.3.3. Evolving Feedback**

Voters who participated in similar BiPSA rounds in the past and the issues they voted on were eventually resolved by reality, now enjoy a reality check in comparing their opinion to the objective outcome. Voters who were constantly right in those past rounds will have a greater impact on the current run. Voters who were consistently wrong in those past rounds will have a greater reverse impact on the current run, and voters who vary with reality in a random fashion will have the smallest impact on the current round. The procedure is essentially as follows:

Given a feedback from a similar controversy which has been resolved by reality, each voter is found to be either correct or incorrect. The correct ones who expressed their opinion with the highest confidence are rewarded the most, the incorrect ones that expressed their opinion in the highest confidence are punished the most (in terms of their individual influence on the integrated result). And similarly in proportion to the degree of confidence in expressing their opinion, the voters are either rewarded (if they are correct), or punished, if they are incorrect.

#### 4.3.4. Integration Procedure:

The integration procedure will first account for the ranked disciplines in the following fashion.

Each discipline will be integrated to its discipline-specific vote. The discipline specific votes will be integrated according to their relative ranking.

This configuration will then be modified according to the evolving feedback data.

**4.3.4.1. Computing The Discipline-Specific Vote:** The procedure proceeds as follows:

1. All voters with non-negligible expertise designation (levels: 1,2,3,4) for the discipline in question will be fed into a BiPSA unit integrator, and produce a "base level discipline integration" (as mentioned, the integrated base level accepts and generates variables in the range:  $(D_0) = \{-4:+4\}$ )
2. All voters with expertise levels higher than 1 for the discipline in question will be fed into a BiPSA unit integrator, and produce a "1<sup>st</sup> level discipline integration" in the range:  $D_1 = \{-4:+4\}$
3. All voters with expertise levels higher than 2 for the discipline in question will be fed into a BiPSA unit integrator, and produce a "2<sup>nd</sup> level discipline integration" in the range:  $D_2 = \{-4:+4\}$
3. All voters with expertise levels higher than 3 for the discipline in question will be fed into a BiPSA unit integrator, and produce a "3<sup>rd</sup> level discipline integration" in the range:  $D_3 = \{-4:+4\}$
4. The four BiPSA values:  $D_0, D_1, D_2, D_3$  will serve as input to a BiPSA unit integrator and produce the summary discipline vote.

This procedure reflects the voter's expertise by: (1) ignoring all voters with zero (0) level of expertise about the discipline in question; (2) counting once all voters with expertise level 1; (3) counting twice all voters with expertise level 2; (4) counting three times all voters with expertise level 3; (5) counting four times all voters with expertise level 4. The impact of each vote depends on the array of values of the other votes that participate in this configuration.

There are no other coefficients, no hidden parameters, no arbitrary settings.

This procedure repeats itself for each discipline of expertise. And so a voter with high credentials with respect to discipline x will influence its summary vote to a large extent, and if the same voter has low credentials with respect to discipline y, she will influence its vote in a reduced measure. This procedure counts each voter for each discipline where his or her credentials are more than negligible.

When this procedure repeats itself for all  $d$  disciplines, then the community votes, however many, are reduced to  $d$  votes, all in the range  $\{-4:+4\}$ .

**4.3.4.2. Integrating The Discipline Specific Votes:** The community at large voted on the ranking of the relevant disciplines. That ranking resulted in associating each discipline with a ranking index in the form of a natural number, such that the higher the number the more influential that discipline.

Based on these influence indices, the  $d$  discipline-specific votes will be integrated to the final vote on the controversy of concern.

The following procedure applies: A base vote will be computed by counting the individual votes of all disciplines. The base vote, is too, in the format  $\{-4:+4\}$ . Then a level 1 vote will be computed by counting all disciplines with an index of influence higher than 1. Similarly a level  $i$  vote will be computed by counting all the votes with an index of influence higher than  $i$ . This will result in computing index-max values, where index-max is the highest influence-level among the  $d$  disciplines. The index-max values will then be fed into a BiPSA unit integrator to produce the fully integrated vote of the community. This vote reflects the individual votes along with their measure of confidence; it reflects the voters' expertise with respect to the disciplines of relevance, and it reflects the community conclusion about the relative relevance of the influencing disciplines of knowledge. No parameter is set up by the BiPSA operator.

**4.4. Long-Term Controversies:** Some controversies may be very critical, yet short term. E.g.: would the stock market drop following a major hurricane lashing into Miami? Others are long term. e.g.: Is global warming preventable by human actions? The latter is a case for repeat BiPSA rounds. Between the rounds the various experts engage in debate, discussion, exchange of arguments, and other means of persuasion. But when the round comes to pass, a binary decision is called for. The successive rounds will measure trends in the community opinion, and of course the consistency of the integrated decision.

Long term cases lend themselves to feedback procedures. Similar short term controversies are forwarded to the community of voters. These short term questions have quick answers that will modify the credentials of the practicing voters.

## 5. Illustration

The question of when will the world run into the troubling state of global peak oil is a question of great significance, and a tense controversy. It's also a long term question (one hopes...). It therefore fits for a BiPSA application.

First one would reduce the peak oil issue into a binary question, like: consider the following statement: *"Peak oil will occur before the end of 2009."* The corresponding binary question will be: is this more likely to happen, or not to happen? Suppose four experts answer the question: Alice, Bob, Carla, and David. All these four BiPSA respondents answer the three standard BiPSA questions, and their answers are translated into the format  $\{-4:+4\}$ :

Alice: +1  
 Bob: -1  
 Carla: +3  
 David: -2

For the sake of this example suppose the community of reference (the four BiPSA respondents plus any other stakeholders), has identified three disciplines of relevance, and ranked them:

- politics: index of influence: 1
- economics: index of influence: 2
- geology: index of influence: 3

The four BiPSA respondents have identified their relevant expertise as follows:

	politics	economics	geology
Alice:	3	2	0
Bob:	1	3	1
Carla:	1	2	0
David:	0	1	4

Accordingly, the integrated vote of politics will be:

- base vote: integration of [Alice, Bob, Carla] =  $[1, -1, 3] = 1$
- first level vote: integration of [Alice] =  $[1] = [1]$
- second level vote: integration of [Alice] =  $[1] = [1]$

The full integration of the politics discipline:  $[1, 1, 1] = 1$

And the integrated vote of economics:

- base vote: integration of [Alice, Bob, Carla, David] =  $[1, -1, 3, -2] = 0$
- first level vote: integration of [Alice, Bob, Carla] =  $[1, -1, +3] = 1$
- second level vote: integration of [Bob] =  $[-1] = -1$

The full integration of the economics discipline:  $[0, 1, -1] = 0$

For the geology vote:

- Base vote: integration of [Bob, David] =  $[1, -2] = -1$
- first level vote: integration of [David] =  $[-2] = -2$

- second level vote: integration of [David]=[-2] = -2
- third level vote: integration of [David]=[-2] = -2

The full integration of the geology discipline: [-2,-2,-2,-1] = -2

The three discipline votes will now be integrated according to the discipline influence index, namely:

- The base discipline vote: [economics, politics, geology] = [1,0,-2]=0
- The first level discipline vote: [economics, geology] = [0,-2]= -1
- The second level discipline vote: [geology] = -2

And hence, the integrated discipline vote, the grand total: [0,-1,-2]=-1

So the community as a whole (in this illustration only) says that Peak Oil will not happen before the end of 2009, but says so with very low confidence.

## 6. Discussion of Merit

BiPSA may be compared to various popular methodologies mentioned in the introduction. Based on the fundamental premise about the supremacy of community wisdom for the long run, every approach that resolves controversy through a single or few decision makers offers a disadvantage towards BiPSA. Albeit, there are numerous mathematical approaches that reduce a variety of input variables into a single variable. Indeed multi-variate analysis is a rich and productive mathematical field with great accomplishments. These mathematical tools suffer from two significant shortcomings compared to BiPSA. The first is computational complexity that generally increases exponentially with the number of inputs. Any established multi dimensional analysis will be prohibitively burdened when the community of opinion sources keeps increasing. The prevailing multi variate tools also suffer from dependence on arbitrary and hidden parameters which endow the operator of the tool with the power to purposefully skew the results while armed with plausible deniability disclaiming that any of his actions was a deliberate tilt towards a desired outcome. Points that look as a dense cluster when a space is cross-scaled one way, will look divergent on a different inter-scaling pattern. But the scaling of one dimension vs. the other is the arbitrary prerogative of the operator. Similarly virtually hidden parameters are found in all other prevailing inference engines. The related shortcoming is visibility. While honest operators will publish and expose the full and detailed account of their data processing, the information is expressed in abstract mathematical language which is hard to decipher, obscure for analysis, and observer-unfriendly. These two factors visibility, and arbitrariness are the central argument for doubts and caution towards the results produced with these tools. Add to it the computational burden for large input count, and you have a clear and sound foundation to be interested in an alternative.

BiPSA by contrast, while mathematically robust, is inherently undisturbed by even a very large number of inputs. So BiPSA can handle votes gathered from a very large community of reference. BiPSA offers complete visibility readily understood by the non-mathematician, and most importantly BiPSA is very low on arbitrary inputs. Virtually all the factors that affect the result are determined by the community of reference. The BiPSA operator has no more ability to affect the results than the framers of the US constitution have with respect to who will be the next president.

BiPSA recognizes the long run supremacy of the community as a whole, but stops short from asserting that every member of the community has the same measure of wisdom with respect to any issue of controversy. In fact, BiPSA maintains the opposite: for any given issue of concern, different people are more qualified to express their opinion than others. Let's compare BiPSA to a representative democracy. In the latter the community of reference (the public) elects members of Congress, or House of Representatives expressing the community opinion that these representatives are the most qualified to render decisions affecting the community as a whole. For practical reasons the elected ones are very few by comparison. BiPSA, by contrast, calls for per-issue election. Every issue under consideration will attract a different profile of impact. The people who are most impactful for one case may be least impactful for another -- not a "fit-all" senators or representatives. BiPSA does not cut off anyone: all members of the community express their opinion, but the impact of each vote is determined by the voice of the community as a whole.

BiPSA rates voters according to three parameters: their confidence in their own opinion, their a-priori credentials, and their evolving performance in similar BiPSA cases. This comprehensive factor accounting endows BiPSA with the property of improving with use. Its credibility gets higher every time it's tried.

### **: 6.1. Does BiPSA Neutralize The Singular Visionary?**

The main criticism levied against BiPSA over the years of its operation is the argument that society has been moving ahead on account of singular visionary individuals who broke off from the community consensus. By promoting a procedure that caters to the community as the ultimate source of wisdom, these mavericks will be undercut.

The best response to this very valid criticism is the "dolphins story": for centuries shipwrecked sailors testified that a dolphin pushed them to shore, giving rise to the theory of dolphin benevolence. It took quite a long time for people to realize that dolphins are simply playful, and push the unfortunate sailors in every direction, only that the few who are pushed to shore live to testify... If society, on account of the heralded stories of against-the-current individuals that have brought great positive change, will listen to every weird and strange voice that counters' community wisdom, then society will go bust fairly quickly. Yes, Harriett Beecher Stowe and her cohorts bucked the trend of slavery in the United States, and we are all thankful for it, but what about cult leaders that call for mass suicide? There are many more of the latter kind than of the first kind.

BiPSA simply puts negotiable obstacles on the roadway of mavericks and visionaries, it does not eliminate them by any means. BiPSA practices a comprehensive outreach -- mavericks included. The opinions of the few who go against the masses is duly recorded, and if reality proves them right, their voice will be more weighty in similar controversies to come. BiPSA beefs up long range controversies with similar short range controversies that give an opportunity for the few super insightful, if there are any, to establish their credibility. For example: running BiPSA for the controversy of peak oil which may be regarded as a strategic long range case (some say it's imminent, and that's the controversy), the operator also puts up short range scenarios with respect to the short range price of oil, the short range record of consumption, and the short range record of discovery of new reserves. These short range cases are resolved by reality pretty soon, and then the insightful who called these issues right will gain credibility that will reflect in achieving a greater impact in integrating the community resolution of the peak oil dilemma. Also, long term strategic controversies are attacked with repeated rounds of BiPSA. The minority opinion has a chance to make its case between these rounds, and create a trend in its favor. In summary, while BiPSA respects the center of gravity of society as a whole, it also gives allowance for the ahead-of-their time visionaries to carry the day.

## **7. Scope and History**

BiPSA began as a project appraisal tool. High uncertainty situations by their nature challenge their estimators and appraisers: how long will the project last, how much would it cost? Practice has shown that by polling all the project stakeholders over clear binary questions (would the project finish within a year – yes/no?), and integrating their opinions in reference to their own confidence in expressing it, qualified by their a-priori credentials, and modified by their polling history over similar projects, the estimate and appraisal become more accurate and more credible. [See G.Samid “Computer Organized Cost Engineering”, 440pp Marcel Dekker, NY]. BiPSA became a major tool for appraising research and development programs and high-stakes innovation undertakings. It’s being cultivated as a key methodology in the Innovation Appraisal Group at the School of Engineering at Case Western Reserve University. The BiPSA concept has proven itself vis-à-vis various challenges where uncertainty is involved. It’s developed for use as an effective inferential engine, a forecasting methodology, a management tool, an intelligence analyzer, a self-organization model, and a cryptographic primitive.

## **Active BiPSA: Controversy-to-Consensus Sites:**

### **Peak Oil:**

<http://www.PeakOilWhen.org>

### **World Terrorism:**

[http://agsencryptions.com/bipsa\\_ict07.htm](http://agsencryptions.com/bipsa_ict07.htm)

### **The Relationship between the US, the West and Israel**

[http://agsencryptions.com/bipsa\\_idf\\_neaman\\_strategy\\_06.htm](http://agsencryptions.com/bipsa_idf_neaman_strategy_06.htm)

### **Israel and its Neighbors**

[http://agsencryptions.com/bipsa\\_idf\\_neaman\\_tactics\\_06.htm](http://agsencryptions.com/bipsa_idf_neaman_tactics_06.htm)

### **Chemical Information Processing – The Next Big Thing?**

[http://agsencryptions.com/bipsa\\_idf\\_neaman\\_tactics\\_06.htm](http://agsencryptions.com/bipsa_idf_neaman_tactics_06.htm)

### **World-Wide University Ranking**

<http://www.bipsa.com/univrank.htm>

### **Public voting on discipline ranking over humanity-challenging controversies:**

<http://www.bipsa.com/knoweigh.htm>

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