How we decide what is right or wrong

We read newspapers and watch TV every day. There are many issues and many controversies. Since media are free, we can hear arguments from every possible side. How do we decide what is wrong or right? The first condition to accept a message is to understand it; messages that are too sophisticated are ignored. So it seems reasonable to assume that our understanding depends on our ability and our current knowledge. Here we show that the consequences of this statement are surprising and funny.

How do we learn?

To demonstrate this, we propose a computational model with two assumptions [1]. The first is that messages can be represented as points on a plane of a finite area, say, a square $a \times a$. Consequently, we can measure the distance between messages. The second assumption is that we can understand a message if it is not too far from what we already know.

As a direct consequence of these two assumptions, we obtain a simple model of learning. In this model the mind is represented by an area around the messages understood by the mind’s owner. Her/his ability is represented by a critical distance $D_c$. A new message can be grasped if its distance to the closest previously understood message is shorter than $D_c$. If this distance is longer, the message is ignored.

Let us consider a new area of experience: differential calculus, traffic regulations, stock market, foreign policy or classic Latin grammar can serve...
Right. The vertical axis can be interpreted as a measure of the distance between Authoritarian and Libertarian, as in [2]. Let us suppose that our model mind is target of a stream of messages, evenly distributed in the square. Again, if \( D_c/a \) is close to 1, the situation is rather trivial; the model mind quickly arrives at full understanding. However, for small values of the ratio \( D_c/a \) the situation is less trivial because bias comes into play. Let us assume at first that our mind is initially unbiased; its owner accepts the first message if it appears within a circle of radius \( D_c \) around the square centre. Yet we can expect that a certain degree of bias will soon develop: it is unlikely that the Left-Right symmetry is preserved for the trajectory of a single mind. An example of this effect is shown clearly in Fig. 1b.

To explain this, we refer to theory of random walk [3]. Suppose that our model is simplified to one dimension, with steps towards left and right at discrete times with equal probabilities. Suppose also that our mind made a step in a given direction. We can then ask the question: how long will it take until it returns? The theory tells us: infinitely long on average. Here we touch upon an important feature of our model. It is clear that each mind will reach full understanding after a sufficiently long time. However, the difference between able (large \( D_c \)) and less able (small \( D_c \)) minds manifests itself always within a finite time. It is just our own lifetime which is finite, and its length provides a scale for everything we do, including understanding things. Compared with the ‘infinitely long’ case from the previous paragraph, this means that, once biased, many of us will never reach objectivity again.

The test
To generalize our model, let us consider a large number of minds, each of which is target of a stream of messages. As we have seen, whether we include an initial bias or not is of secondary importance. Now we are going to design a test of social common sense in our artificial society.

An example - how we think about politics
As we are political animals, let us apply the model to our political beliefs. In this field, public discussions are most aggressive and arguments least convincing. Trying to be objective – as scientists should be – we choose our square to be symmetrically divided between two orientations: Left and Right. The vertical axis can be interpreted as a measure of the distance between Authoritarian and Libertarian, as in [2].

Let us suppose that our model mind is target of a stream of messages, evenly distributed in the square. Again, if \( D_c/a \) is close to 1, the situation is rather trivial; the model mind quickly arrives at full understanding. However, for small values of the ratio \( D_c/a \) the situation is less trivial because bias comes into play. Let us assume at first that our mind is initially unbiased; its owner accepts the first message if it appears within a circle of radius \( D_c \) around the square centre. Yet we can expect that a certain degree of bias will soon develop: it is unlikely that the Left-Right symmetry is preserved for the trajectory of a single mind. An example of this effect is shown clearly in Fig. 1b.

To explain this, we refer to theory of random walk [3]. Suppose that our model is simplified to one dimension, with steps towards left and right at discrete times with equal probabilities. Suppose also that our mind made a step in a given direction. We can then ask the question: how long will it take until it returns? The theory tells us: infinitely long on average.

Here we touch upon an important feature of our model. It is clear that each mind will reach full understanding after a sufficiently long time. However, the difference between able (large \( D_c \)) and less able (small \( D_c \)) minds manifests itself always within a finite time. It is just our own lifetime which is finite, and its length provides a scale for everything we do, including understanding things. Compared with the ‘infinitely long’ case from the previous paragraph, this means that, once biased, many of us will never reach objectivity again.

The test
To generalize our model, let us consider a large number of minds, each of which is target of a stream of messages. As we have seen, whether we include an initial bias or not is of secondary importance. Now we are going to design a test of social common sense in our artificial society.
As the messages are evenly distributed, neither Left nor Right arguments prevail. Knowing this, we can expect that a reasonable person remains objective. What is the result?

To answer this, let us introduce a probability \( p \) that a given mind’s owner, when asked about her/his preference, is going to answer “Right”. Likewise, a probability \( q \) is assigned to the answer “Left”, with the obvious condition \( p + q = 1 \). For each mind, the probability \( p \) will be calculated as follows. The number of all messages he or she understood within a given time is \( N \). This set is divided into \( N(L) \) and \( N(R) \), where \( N(L) \) is the number of understood messages placed on the left part of the square, and \( N(R) \) for the right part. Obviously, \( N(L) + N(R) = N \). Then, \( p = \langle x(R) \rangle / \langle |x| \rangle \), where

\[
\langle x(R) \rangle = \sum_{i} N(R) x(i)
\]

is the mean x-coordinate of messages on the right half-plane, and

\[
\langle |x| \rangle = \sum_{j} N |x(j)|
\]

is the mean absolute value of the x-coordinate of all messages. Probability \( p \) is now calculated separately for each mind [1].

What is the probability distribution of \( p \) itself? The answer is shown in Fig. 3, for different values of the ability parameter \( D_c \). As we see, both plots preserve the Left-Right symmetry within the accuracy of statistical errors. For large values of \( D_c \), the resulting probability distribution is centered around the value \( p = 0.5 \). By contrast, for small \( D_c \), the distribution consists of two sharp maxima close to \( p = 0 \) and \( p = 1 \). In other words, in the former case of large ability a statistical mind answers “Left” and “Right” with equal probabilities. This is equivalent to the answer “I don’t know”, the only reasonable answer because the incoming messages do not provide arguments for a more decisive statement. However – and this is our most important result – for a society characterized with small ability \( D_c \), a statistical mind answers either surely “Left”, or surely “Right”. In other words, in the case of small mental ability all opinions are extreme.

Additional remarks

The model [1] has been further developed to include consequences of interpersonal communication: minds not only hear but also articulate their opinions, which are included to the stream of messages. To mention two main results, we note that an intensive communication leads to a clustering of opinions, which become more extreme even for the case of moderate ability [4]. On the other hand, the latter unanimity disappears if messages are addressed to minds which are neighbors in the square of issues. Then, again, the opinions are less extreme [5]. These results lead one to be cautious about situations in which unanimity is treated as good and conflict as evil.

Alas, in our world unanimity is almost always against somebody else. In that case the contradistinction is not “unanimity vs. conflict”, but rather “diversity vs. extreme”.

Paraphrasing Paul Géraldy, one could say that it is the political party who chooses the man who will choose her. This means that everybody will be chosen by some party. Yet a simple “I don’t know” seems a good remedy against an extreme “Yes” or an extreme “No”. What is funny (at least for us) is that this is the result of a model based on statistical mechanics.