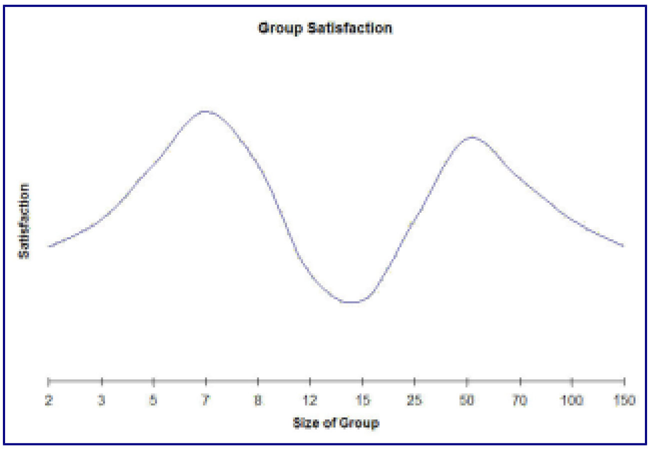
# Chapter 12: Ruling Ourselves

## Footnote: Forming a Cohesive Group

> *The ideal size for a group of people depends on the way the group is intended to function. For a cohesive egalitarian group of equal peers, the optimum number of members is 7. For a task-group under the exclusive command of a single director, the ideal size is 12. Why is this?* [PDF]

Many ideas and discussions can be found on the Web relating *group size* to *group cohesion*. Sources are really too numerous to cite fairly, but the collective essence appears to me as follows. There appears to be an upper limit as to the number of people any individual can "know". That number is about 148 and is commonly referred to as the Dunbar Number. However, this is considered by some to be a maximum that applies to superficial social relationships. The individual's capacity for relationships involving trust is considerably less, and for intimate amorical relationships, less still.

Empirical observation has been made of member satisfaction within groups who engage in interactive games on the Internet. An excellent discussion on this topic can be found here. The author there expresses his anecdotal evidence in a graph (thumbnailed on the right). Click on the graph to see the original on the author's website. This graph shows the first maximum for member satisfaction occurs for a group comprising 7 individuals, with the first minimum occurring at 14.




This implies that member-satisfaction is good for groups of between 5 and 8 people, while groups of from 11 to 22 people have low cohesion between members. It is interesting to note from the graph that the satisfaction of (and hence the inherent cohesion between) the members of a group of 2 (i.e. a couple) is the same as that for groups of 11 and 22. It is low. Another maximum occurs at just over 50 people. This then falls off until, at 150 people, the level of member satisfaction is the same level as for group sizes of 2, 11 and 22. This anecdotal data is not only derived from Internet game groups. Many types of human groups seem to exhibit close, if not identical, profiles of size versus satisfaction (or cohesiveness). The author of the above-mentioned website also engages in what I would call fairly convincing thought experiments that lend good weight to the anecdotal data.

So, what kind of mechanism could be causing this phenomenon? Suppose the human brain gives each of us (our conscious minds) 6 real-time relationship channels. In a group with 7 members, each member has 6 relationships. Each relationship has a dedicated channel. This is the ideal situation. Every member's relationship needs are fully satisfied and fulfilled.

| | |
|---|---|
| 2 | 0·166666667 |
| 3 | 0·333333333 |
| 4 | 0·5 |
| 5 | 0·666666667 |
| 6 | 0·833333333 |
| 7 | 1 |
| 8 | 0·833333333 |
| 9 | 0·666666667 |
| 10 | 0·5 |
| 11 | 0·333333333 |
| 12 | 0·166666667 |
| 13 | 0 |

However, in a group of 8 members, each member has 6 channels with which to service 7 relationships. Each channel is therefore having to service 7/6 = 1·166666667 relationships. So its attention is somewhat divided. The effect of the overload or interference from another relationship is to attenuate its ability to attend to any one relationship. So it will have only 1 − 0·166666667 = 0·833333333 of the resources or concentration per channel that it would have for 6 relationships.

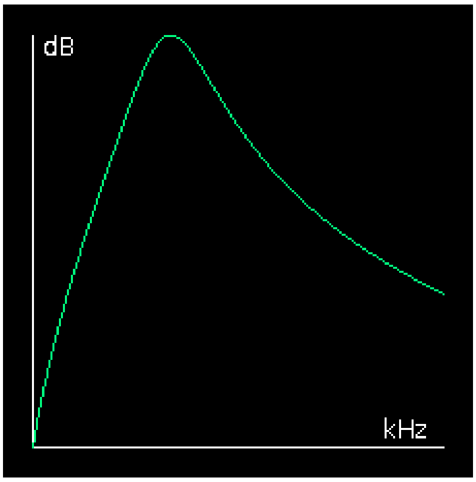
The adjacent table shows how, on this basis, attention resources per channel for group sizes from 2 to 13 are attenuated below that for a group of 7.

Unfortunately, this table gives rise to a symmetrical linear graph, not the curved graph derived from the anecdotal data. The anecdotal curve is non-linear. The relationship must therefore be somewhat more complicated than this.

The shape of the curve shown in the above graph is reminiscent of the response of a tuned circuit or filter as used in a radio receiver. It also looks similar to the well-known bell-curve of statistical distributions. However, when I tried to reproduce this curve in terms of the numbers of relationships between people in different group sizes, I failed.

I considered both direct relationships between members and indirect relationships of each member viewing the relationships between all the other members of a group. Still, I could not create anything non-linear. Even going super-regenerative by considering how one member would relate to another through other members of a group going round in loops didn't work. Consequently, I do not think this curve comes directly from the relationship network between the members of a group.

I do not think that the bell-shaped curve is due to any statistical phenomenon. It does not represent a composite effect of many groups together. Rather, it seems to represent what could be termed the *resonance* within a group in relation to its size (its number of members). It seems that 7 people can tune into each other as a group better than 5 or 9 people can, and so on. This leads me to think that group cohesion is a phenomenon more akin to that of a radio receiver tuning into a transmission. I therefore tried to reproduce the anecdotal curve mathematically using the attenuation formula for a tuned circuit.

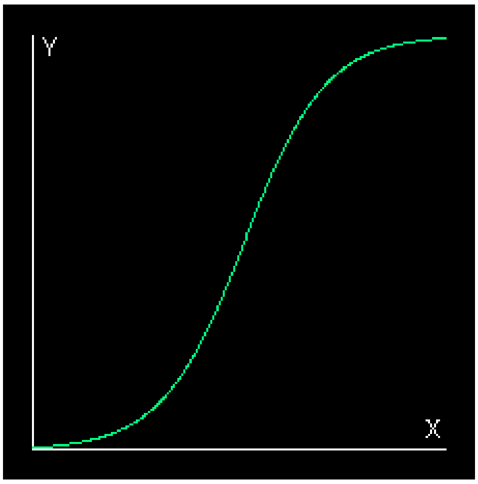



My mathematically-generated version of the curve is demonstrated by the applet on the left. The curve's profile does not coincide exactly with the anecdotal data, but that is probably because I did not spend enough time tweaking the various constants in the equation. The graph was generated using the formula: $A = (X^2+R^2) / R^2$. X is the circuit reactance $X=\omega L-1/\omega C$. ω is the angular frequency of an applied signal. C is the capacitance (0·278μF), L is the inductance (0·278μH) and R is the resistance (0·223606798Ω) of the tuned circuit. The formula is actually for two cascaded tuned circuits.

I have taken a bit of license in that I have re-scaled its vertical axis to represent group cohesiveness as an index ranging from 0 to 1. The values have also been idealised in that I iterated the difference equation **y += k*y*(1 - y)** to make the curve follow a sigmoid profile. The profile is not exactly symmetrical, so the value of **k** had to be varied slightly with group size. In other words, **k** (normally a constant) turns out to be a function of group size.

So it seems that, in the relationship between group size and cohesion, there are factors at play that exhibit the characteristics that reactance and inductance do in a tuned circuit. I imagine a multi-diversity receiver that can receive concurrently on 6 separate channels. If each channel is 10kHz wide, then together they occupy 60kHz of band-space.

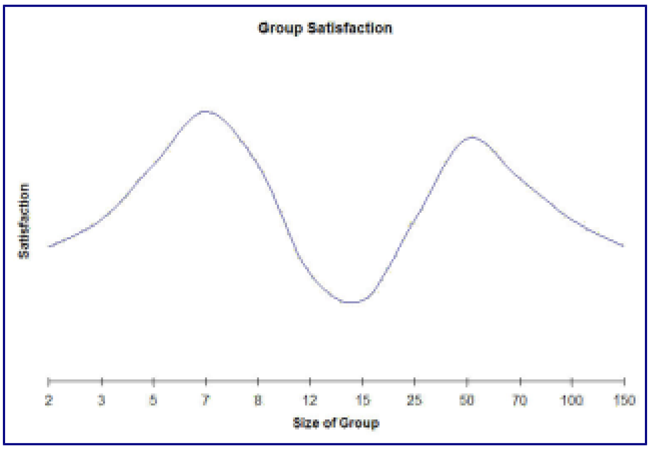
If there are 6 radio stations on frequencies corresponding to the receiver's channels, reception will be optimal. However, if there are 7 stations or 5 stations spaced equally across the same band-space, their signals will not coincide exactly with the receiver's 6 channels. Each channel of the receiver will either receive a slightly off-tune station or 2 or more stations interfering with each other on each channel. For 8 or 4 stations, the situation is worse. For 3 or 9 stations and 2 or 10 stations, the situation becomes progressively worse still. This "tuned circuit" curve is somewhat asymmetrical, just like the curve derived from anecdotal data shown at the beginning of this article.




But, in the relationship between group size and cohesion, where does the non-linearity come from? One place I have seen this kind of relationship profile is in the input response of an artificial neurone in a neural network program. In fact, I wrote such a program years ago using the same difference equation **y += k*y*(1 − y)** to create the sigmoid profile for the neurone's input response. This same bit of program drives the adjacent applet, which illustrates the function. Click your browser's RELOAD button to watch the applet generate or re-generate the curve.

I shall therefore speculate that perhaps this non-linearity comes from the natural neurones of the human brain.

The graph derived from anecdotal data has a second cohesion peak for a group size of about 52. It is an interesting observation that this is close to 49 which is 7 times 7, the first peak. Perhaps 7 groups of 7 have strong cohesion between the groups themselves rather than between the 50 individuals. Notwithstanding, I think that the type of relationship, that characterises a group of 50 or so, is not the same as that which characterises a group of 7.




I think the relationships between members of a group of 50 is more tribal than intimate. Such relationships may be individual. Each member of a group of 50 may really know who each other member is and what kind of person each is. However, it is not so interactive to any profound level in the way the intimate relationship is.

My final observation from the anecdotal graph is that cohesion is a minimum for three group sizes: 2, 12 to 17 and around 150 members. A marriage comprises 2 members. Sports teams and work-groups comprise 12 to 17 or so members. Well-tuned commercial operations and army companies comprise around 150 members. Why do such dedicated-purpose groups gravitate to sizes of least cohesion?

The answer that springs to my mind is that it is because the lack of cohesion between members makes the team easy to command and control. They are like a spoked wheel without a rim. A leader can dominate each individual because each individual is relationally isolated from his fellow group members. It is the ideal component of any hierarchical system. Team members are merely extensions of the leader's mind and limbs. They are robots.

But what about marriage? Modern marriage has its origins in Rome. A Roman possessed his famulus (from which we get the word family). This comprised his land, his wife, his children, his slaves and all his other goods and chattels. In other words, it is a system or hierarchical domination just like an elite-controlled state or a modern commercial corporation.

Of late, State and religious institutions have relaxed their rules regarding a husband's right to command the unconditional obedience of his wife. Nevertheless, the binary structure of marriage has persisted. Since a group size of 2 has minimal internal cohesion, a marriage can only, in most cases, be kept intact over the long term by external social and religious pressures.

---