“OO-OO-OO!” The Sound of a Broken OODA Loop

Dr. David G. Ullman
Robust Decisions Inc.

The OODA Loop was designed to describe a single decision maker, the situation is usually much worse than shown as most business and technical decisions have a team of people observing and orienting, each bringing their own cultural traditions, genetics, experience, and other information. It is no wonder that we often get stuck here, and the OODA loop is reduced to the stuttering sound of OO-OO-OO.

Getting stuck means that there are no decisions and thus no actions. In reality, a decision has been made to do nothing. Time keeps moving, and resources are used. In Boyd's warfighter scenario, the enemy gets the upper hand. In business, the competition keeps progressing in its OODA loops while you keep using your resources while adding no value. In other words, getting stuck at the decision point can have severe, even grave, consequences.

The organizational response to being stuck is often more analysis, more data, more simulations, or more decision by wringing hands. Sometimes these efforts help, if directed at the right sticking point, but often these activities only postpone decisions until some external event occurs that demands a decision. This results in decision by running out of time or, if the action is dictated by a superior, decision by fiat. Neither of these have much chance of being a robust decision.

An important feature of the OODA loop is that it is not static, it is a loop. Efforts at orientation affect what is observed and how the actions are implemented. Each decision and action changes the context for the observations, and the result of the action on the environment causes a push-back that affects the information being observed. Competitive advantage comes from quickness over the entire loop, and, as with each iteration, the changes are smaller (as they are modifications to an understood situation) and can be more easily managed – therefore staying ahead of the competition.

To explore why we get stuck, consider the expanded OODA loop in Figure 2.

In this diagram, the OODA loop elements are detailed as activities that are keys to success. The dark box around orientation and decide emphasizes where the bulk of the discussion is focused. In the following, think of each task in a project or the development of each feature in a product as an OODA loop.

Observations originate from human sources as well as from data, test results, intelligence sources, and models about a situation. In software and product development, observations include the following: formal specifications developed by the customer; competition's products; the results of data collection; and the incomplete and evolving results of other projects. Regardless of the observation source, this information is evolving, inconsistent, uncertain, incomplete, and is dependent on who is doing the observing (e.g. two intelligence sources may give conflicting information, or two engineers may interpret the results of a simulation differently). Further, some of the information is qualitative and some is quantitative. This informational mess is characteristic of most critical combat, technical, product development, and business situations. The goal

Figure 1: OODA Loop

Col. John Boyd, U.S. Air Force fighter pilot ace, developed the concept of the OODA Loop to describe the process needed to win at war. This model matured as he won aerial dogfights in Korea and Viet Nam and later used it to describe how to gain a competitive advantage in any situation. Recently, the OODA loop has begun to be applied to business and product development as a way to describe their decision-making cycles. In these situations, the loop often gets stuck at the D and the team is reduced to making a sound like OO-OO-OO. The OODA loop is a succinct representation of the natural decision cycle seen in every context: war, business, product development, or life.

Boyd diagramed the OODA loop as shown in Figure 1. In words, all decisions are based on observations of the evolving situation tempered with implicit filtering based on the problem being addressed. These observations are the raw information on which the decisions and actions will be based.

The observed information needs to be processed to orient it for further making a decision. In notes from his talk Organic Design for Command and Control, Boyd said:

The second O, orientation – as the repository of our genetic heritage, cultural tradition, and previous experiences – is the most important part of the OODA loop since it shapes the way we observe, the way we decide, the way we act. [1]

As stated by Boyd and shown in the Orient box, there is much filtering of the information through our culture, genetics, ability to analyze and synthesize, and previous experience. Since the OODA loop was designed to describe a single decision maker, the situation is usually much worse than shown as most business and technical decisions have a team of people observing and orienting, each bringing their own cultural traditions, genetics, experience, and other information. It is no wonder that we often get stuck here, and the OODA loop is reduced to the stuttering sound of OO-OO-OO.

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of orient is to reduce this mess so we can decide what to do next and take action—collect more information, involve more people, or turn our attention to other OODA loops.

The goal of orientation is to make sense of the observations. This requires understanding the observations as a basis for choosing the best course of action. In many cases, formal analysis can help reduce this fog, but much of the information cannot be easily modeled. Thus, how this information is managed to match the human decision-makers’ needs is crucial.

Orientation also is dependent on viewpoint. Even on the same team, how the observations are understood is dependent on who is trying to understand them. As Boyd pointed out, understanding is dependent on previous experience, cultural traditions, and genetic heritage. Beyond these measures, understanding is also dependent on one’s role in the organization and team objectives. Helping a team make sense of the situation and develop a shared understanding while honoring the different viewpoints is a challenging but necessary part of getting team buy-in and making a robust decision.

Orientation should aid in the sharing of implicit knowledge. By this we mean that in trying to make sense of the situation and fuse the observations, some of the stakeholder’s implicit knowledge must become explicit and be communicated to others.

Often the OODA loop stalls because the decision makers are not comfortable with the uncertainty. Managing uncertainty implies that beyond concern there is an effort to do the following: measure the uncertainty, control what you can, and minimize the effect of that which you cannot control. Uncertainty creates risk that a poor decision will be made. This is over and above traditional risk consideration—risk based on past statistics that give information on the probability of occurrence and consequence. Since decisions require a look into the evolving future, traditional probability methods (often called frequentist methods) for managing risk and uncertainty cannot be applied. Recently, Bayesian methods have been used to help manage these situations (see item in 4c, to follow).

A key part of orientation is developing alternative courses of action. In the words of the French philosopher Emile Chartier, “Nothing is more dangerous than an idea when it is the only one you have.” In engineering design and software development, this means actively searching for multiple options to consider.

Making a decision is not a single action, but is a process of repeatedly deciding what to do next—observe more information, do further orientation, or take action. A major component of this is managed deliberation, which is synergistic with Orient, as it is part of sense-making and can help lead to a shared vision of observations. Managed deliberation implies the following:

- Identifying the areas on which to focus based on benefit of further effort. This is a major sticking point in the OODA loop. It is often difficult to see where more work needs to be focused. The benefit is usually hard to measure, but it should be in terms of the following: 1) anticipated change in satisfaction with a course of action, 2) anticipated change in the risk with a course of action, or 3) anticipated consensus or buy-in from management or team members.
- Identifying the cost of further effort. This also is a major sticking point in the OODA loop. The cost of doing more work is usually in terms of the time used and the expense for researching, testing, or consulting.
- Identifying areas where consensus is low and impact is high. The goal here is to separate areas that need effort (consensus is low and impact is high) from points that are not critical to a decision. Part of choosing what to do next is separating out what is easy to do from what will actually provide understanding needed to make a decision.

Managed deliberation implies OODA loops inside OODA loops as the decision about that to work on next requires its own OODA activities.

Deciding what to do next requires fusion of the orientation results. As with the observations, the result of orientation is usually evolving, inconsistent, incomplete, uncertain, and dependent on who is doing the orientation. Somehow, this oriented information must be fused to develop a picture of the situation that is cognitively small enough to decide what to do next.

Fusion may be both an analytical effort and a consensus building effort. Analytical methods range from formal optimization to methods that combine the subjective opinions of team. More importantly is building collaboration to get buy-in on the chosen action. Collaboration requires that the following is present:

- Everyone can paraphrase the issue to show that it is understood.
- Everyone has a chance to contribute to the solution of the problem.
- Everyone has a chance to describe what is important.

Those who do not agree with the final decision will more likely support the team because they have been included in the decision-making process and appreciate the compromise needed to reach a decision.

The proof of the success of the OODA loop is in the success of the Action taken. Here, think of actions as work activity or pieces of information that affect work activity. All action affects future observations. In Why Decisions Fail[2] the author studied 400 decisions made by senior managers in medium to large organizations. He considered the decision a success if it was sustained for two years after the decision was made. In other words, the action taken had noticeable impact two years later. He found that fully half of the decisions failed to have any impact beyond the use of resources.

It is clear that many decisions in information technology OODA loops fail. According to the 2004 Chaos Report[3], 53 percent of products are delivered late or over-budget, and an additional 18 percent are cancelled. Further, projects completed by large companies have only 42 percent of the originally designed features and func-

Figure 2: Expanded OODA Loop
tions. Features and functions are often jet-
tisoned during a project to help meet 
schedule and budget. This is often referred 
to as descoping a project; some organizations 
build descoping into their original plans. 
The Chaos Report numbers may be worse 
than stated as they are self-reported.

Guidelines for Unsticking the 
OODA Loop

As ubiquitous and important as the 
OODA loop is, most of us receive little 
training in how to perform the two key 
elements of orient and decide. Sure, we 
pick up some clues from our formal train- 
ing, yet we are never formally trained in 
the OODA elements. Even in military 
training [4], there is little detail about how 
to manage them. Itemized here are a few 
guidelines for staying unstuck and for 
making robust decisions, especially in 
product and software development.

The Entire OODA Loop:

1a. Identify the OODA loops in your 
organization and their interactions. 
Each OODA loop provides the envi-
ronment for other interacting OODA 
loops. Consider each task or feature 
development as an OODA loop and 
think through O-O-D-A.

1b. For each OODA loop, ensure you 
know who the resulting actions will 
 affect because they, in turn, may affect 
your observations as your loop is 
refined.

Observe

2a. Make sure you know the properties of 
observations. Each piece of information 
comes with details about its stability, 
consistency, certainty (see 2b), comple-
teness, and its dependence on the 
observer. Note these and formalize 
them, if possible.

2b. All observations are uncertain. Early in 
the design of a system, uncertainty is 
dominated by lack of knowledge – cog-
nitive uncertainty. As systems mature, 
much uncertainty is due to natural vari-
ance in the environment and nature of 
materials. In software development, 
variation is small compared to cognitive 
uncertainty. Anytime anyone gives you 
an estimate, the results of a simulation 
or experiment, or an opinion, you must 
tag it with a level of certainty. You need 
to make this explicit. Engineers and 
financial analysts in particular are prone 
to giving single, deterministic values for 
information that is really a distribution. 
Push back on them to find the distribu-
tion, even if it is in terms such as very 
sure, about, or sort-of. Early in the de-
velopment of a system, all estimates are 
uncertain and need to be managed as 
such (see item 3d).

Orient

3a. Since orientation is so important, it is 
amazing that more emphasis is not put 
on its component parts. The major 
function of orientation is making sense 
of the observations. Since all observa-
tions are understood only in relation to 
what the orienter knows; sense is differ-
ent to each person presented with the 
observations. Thus, one sticking point 
is when the person responsible for the 
OODA loop does not have sufficient 
knowledge to orient and knows it. This 
realization may take awhile. Thus, if 
responsible for a decision and it is not 
 happening, ask if it is because of insuf-
ficient knowledge to make sense of the 
situation. If so, find people who do 
have the knowledge.

3b. If a problem is sufficiently complex 
that a team is involved, then each per-
son on the team has a different context 
for orienting. Here, sense making is 
communal and challenging so no one 
person has either a complete picture or 
the capability of developing one. It is 
possible to have meetings to discuss 
the observations without significant 
sense making. The key is to set up 
environments that support sense mak-
ing by sharing pertinent information 
needed for the decision. Implicit 
knowledge needs to be made explicit 
in a form that is understandable by 
others who have a different context 
for understanding the observations.

3c. In a team situation, during orientation,

“... understanding is 
dependent on previous 
experience, cultural 
traditions, and genetic 
heritage. Beyond these 
measures, understanding 
is also dependent on 
one’s role in the 
organization and team 
objectives.”

Decide

4a. Making a decision is essentially deciding 
what to do next. The default is to do 
nothing – getting stuck on OO-OO-
OO. Being stuck is a clear call for any 
of the following:

• Build consensus with the informa-
tion you have. This pushes back on 
orientation – managing viewpoints, 
sharing implicit knowledge, collab-
orating, and developing new cours-
es of action. This is the first choice 
about what to do as it is the most 
cost effective.

• Perform more analysis to refine the 
orientation information. This is 
generally more expensive than 
working with the information you 
have and can lead to paralysis by 
analysis – the risk-averse activity of 
trying to drive out all uncertainty 
by undertaking increasingly higher-
fidelity simulations of the situa-
tion. When the fidelity of the sim-
ulations is superior to the certainty

there will be multiple viewpoints about 
what is important. It is necessary to 
separate what is important from what 
is to be achieved. For example, the cost 
of an alternative may be very impor-
tant to some and not as important to 
others. This fact needs to be separated 
from the estimated cost of each alter-
native being considered. The uncer-
tainty in the estimate may swamp 
the differences in importance, but only if 
this separation is made explicit. To 
restate this, separate out what is to be 
achieved (i.e. goals, targets) from how 
important it is to achieve them. 
Further, disagreements about what is 
important can be an asset as manage-
ment of them can support collabora-
tion leading to action buy-in.

3d. Since observations are uncertain, orienta-
tion methods need to be able to manage 
uncertain information whether quanti-
tative or qualitative. The risk of not 
making a robust decision is dependent 
on managing this uncertainty. One way 
to tackle uncertainty in software devel-
opment is through simulation and test-
ing across the range of the uncertainty. 
This has been formalized through the 
use of design of experiments (DOE) 
and Taguchi methods [5].

3e. During orientation, make sure you are 
considering multiple courses of action 
and can itemize them. Develop meth-
ods within your organization that 
courage this. Find ways to help the 
champions of each idea compare and 
contrast their alternatives with others.
of the observations on which the simulations are based, time and money are being wasted.

- Return to observation and collect more information. This is almost always more expensive and time consuming than the previous two options. If the information that will reduce the risk and unstick the decision is collectable, it may be worthwhile.

4b. Work toward learning from past decisions. Knowing how well you are doing requires keeping track of decisions made, the actions that follow, and the success of the actions (i.e. did they stick?). This is seldom done in a fashion that makes it possible to learn from OODA loop successes and failures.

4c. Develop methods that manage the fusion of uncertain observations and orientation in support deciding what to do next. Formal tools that help you do this just being developed. Since decisions are based on uncertain estimates of the future, Bayesian methods are ideal for supporting such activities [6]. In one such effort developed by the author, Bayesian tools are packaged in a distributed team decision-support system. In this system, there is no need to understand the Bayesian mathematics that are hidden behind an easy-to-use graphical user interface. This system attempts to estimate the risk of making a poor decision and, in many ways, supports the management of the uncertain observations and orientation.

Act

5a. A decision that has both high buy-in and accountability naturally generates actions that are aligned with the decision made. The opposite is also true. If a decision is made and it is not followed by consistent actions, then the problem may lie in earlier OODA activity (especially see items 3b, 3c, 4a, and 4c).

5b. Associate the actions taken with specific OODA loops (e.g. tasks). If you cannot identify where an action initiated then it may be an assumption that has no formal OODA activity behind it and may be spuriously driving other loops. Think of actions as any work effort or piece of information that is affecting work effort.

In summary, the OODA loop model is an easy way to think about your product development effort. It can help focus on problems that occur along the way—especially if you hear your organization stuttering OO-OO-OO. Following these guidelines can help unstick your OODA loops.

References


Note

1. The sound “OO-OO-OO” was verbally described in a presentation by Harvey S. Gold, lead design for Six Sigma and Black Belt, DuPont CR&D, June 2005.

About the Author

David G. Ullman P.E., Ph.D., (Emeritus Professor of Design, Oregon State University) has researched design and decision making for more than 25 years. Recently, his research has focused on the importance of decision-making in the product realization process. He is an active software and hardware designer. His recent book, Making Robust Decisions, was published in December, 2006. Additionally, he is the author of The Mechanical Design Process, 3rd edition. He is an American Society of Mechanical Engineers Fellow and a registered Professional Engineer.

Robust Decisions, Inc.
1655 Hillcrest DR
Corvallis, OR
Phone: (541) 758-5088
(541) 754-3609
E-mail: ullman@robustdecisions.com