



One Loop to Rule Them All

Berndt Brehmer

Department of War Studies

Swedish National Defence College

berndt.brehmer@fhs.se

Purpose

The purpose is to present a general model for the study of C2 and to guide the design of C2 systems

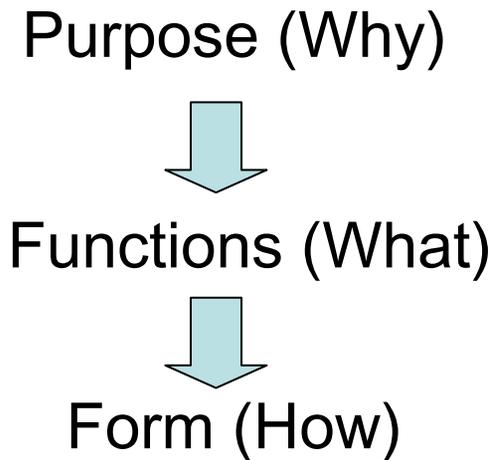
Outline

- A general point of departure
- Design logic
- General concepts
- Two varieties of C2 Science
- The Dynamic OODA loop (DOODA loop)
- Research guided by the DOODA loop
- Conclusion: The loop to rule them all

Understanding C2: A Point of Departure

- C2 is often conceptualized as a global *decision process* (MDMP) or *planning process*
- This not very helpful; the C2 process must be broken down into its components and put into its context
- C2 is performed as part of a C2 system
- The C2 system system is a function in a mission system
- It can only be understood and evaluated in terms of that system
- C2 systems are artefacts *designed* for a purpose
- They must therefore be understood in terms of *design logic*

Design Logic



- The *purpose* tells us what the system is for
- The *functions* specify what needs to be done to achieve the purpose
- The *form* of the system tells us how the functions are achieved

Purpose, Function and Form

- The *purpose* of C2 is to produce military effects
- The *functions* represent what we understand about what is required to produce military effects
- To find the functions is a matter for *C2 theory*
- The *form* is the organization, methods, procedures, processes, and systems of the C2 system
- To find the form, it is necessary to understand the functions and what is required for achieving them
- The form is dependent on current technology
- The form therefore varies from time to time, but the functions are hopefully timeless

Two Varieties of C2 Science

- *Normative C2 science*: How C2 should be performed → Finding the functions
- *Descriptive C2 science*: The study of form: How C2 is actually performed in a given situation → Finding the organization, methods, procedures, processes, systems and products of the existing C2 system

Design of New C2 Systems

- Design of a C2 system (as well as the exercise of C2) must be based on a specification of the functions to be performed by the system
 - Designing on the basis of form is likely to be conservative
- Evaluation of a C2 system must be based on a study of the products of the system
- The products can be used to assess the extent to which the functions are achieved

Empirical Study of C2

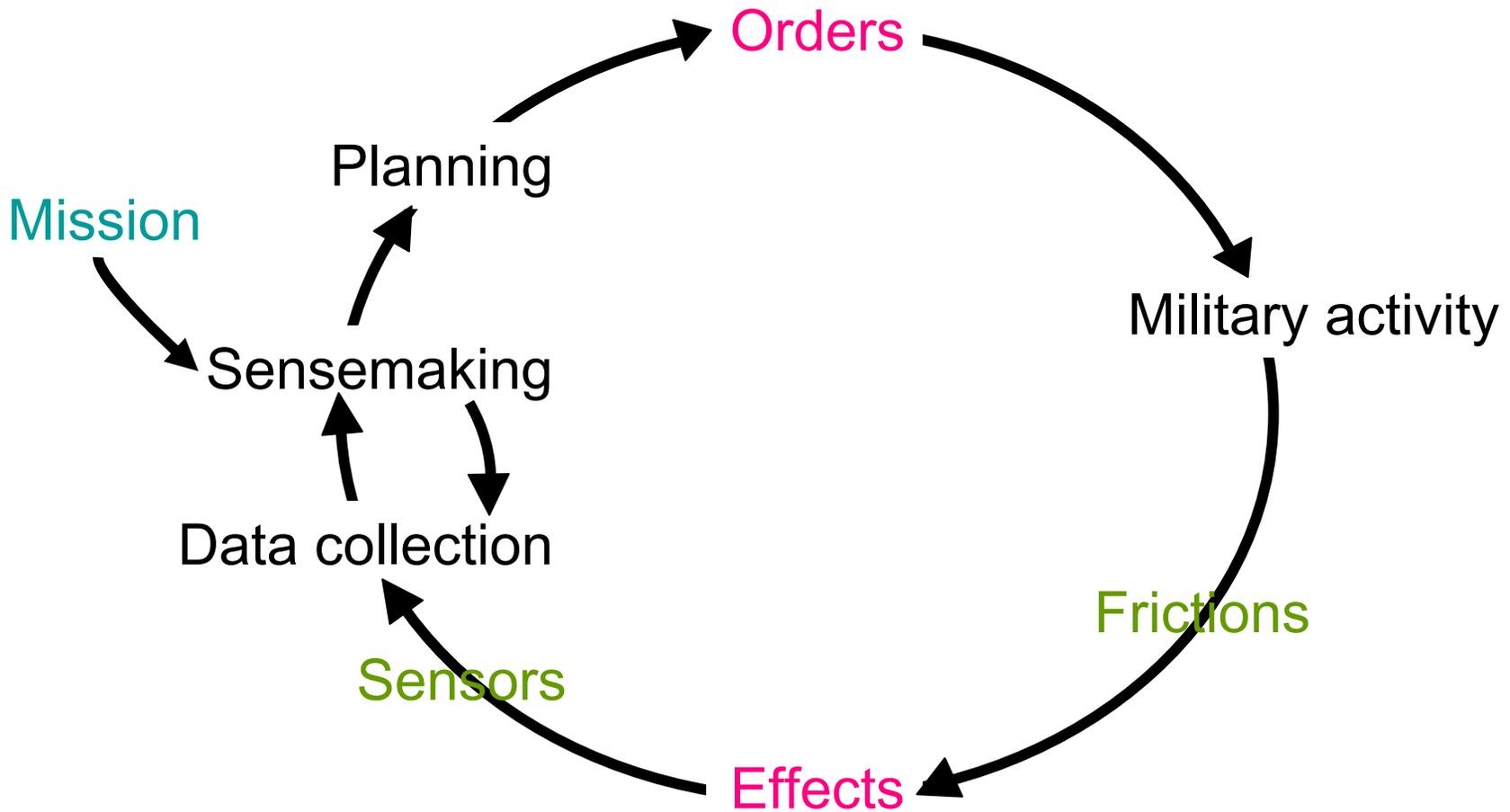
- Products and processes can be observed and assessed
- Functions must be inferred
- The quality of the products is used to infer the extent to which functions are achieved
- The quality of the products can be related to the characteristics of the processes
- The study of C2 at the level of form is likely to be bewildering
- It must be guided by an understanding of the functions

Existing Conceptions of C2 Do Not Provide a Useful Description of the Functions in a Relevant Context

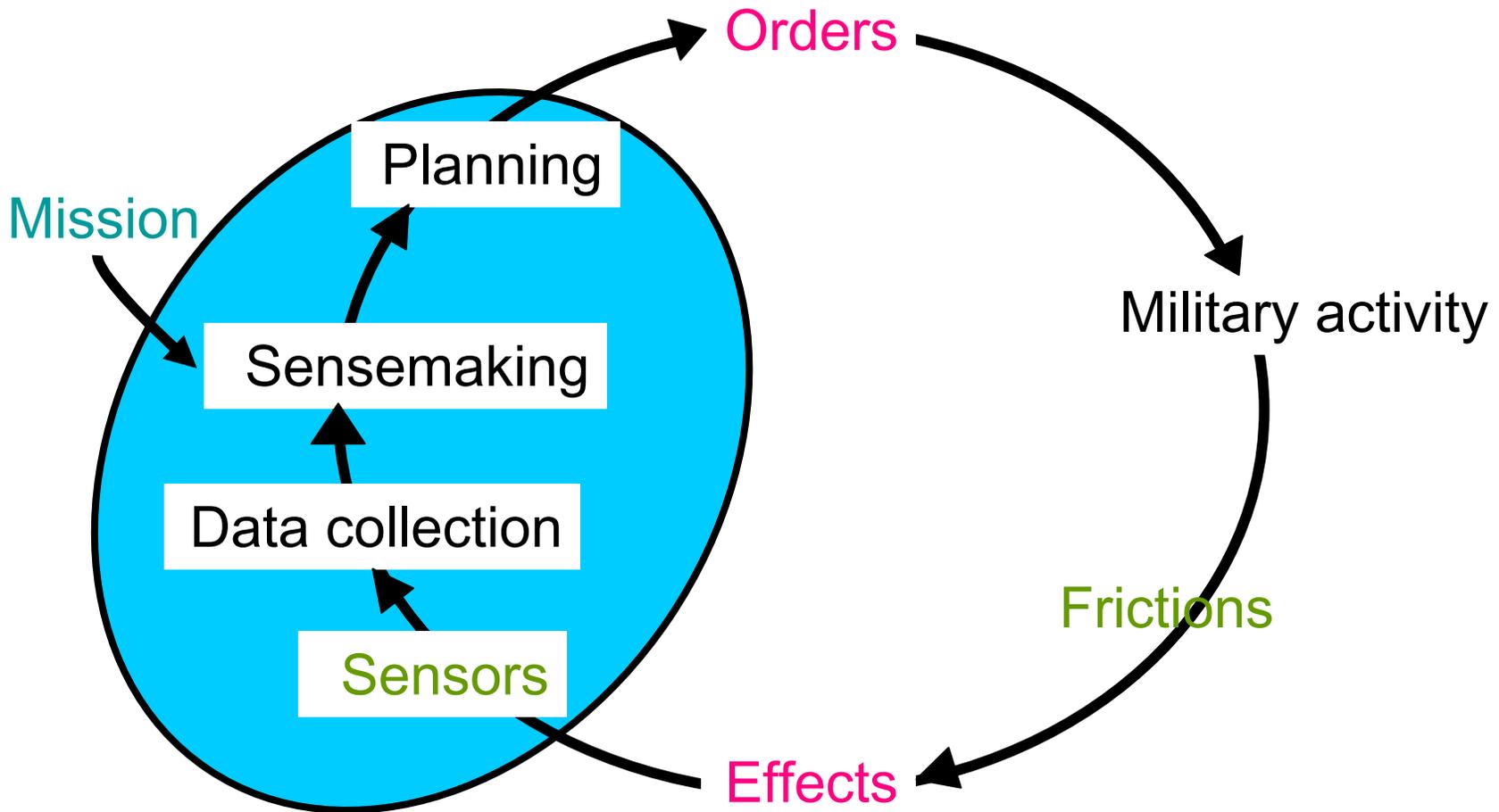
- Boyd's OODA loop is limited because it does not include the effects
 - It therefore only recommends faster decisions
- The cybernetic models include the effects but
 - these models are too general, they could be models of a process plant as well as of the C2 process
- Therefore, these models do not serve as a good guide for designing C2 support

→ We need a model that gives a more useful description of the functions in C2

The Dynamic OODA loop (DOODA loop)



The C2 System as Part of the Mission System



The General Conception of C2 in the DOODA loop

- The purpose of C2 is to achieve the goals stated in the mission
- While we may isolate an episode starting with a mission and ending in orders, C2 is continuous
- Command is found in the orders, control in the feedback
- Command is guided by the sensemaking which is a continuous function providing an understanding in terms of whether something more needs to be done to accomplish the mission
- Command and control are thus fused once the mission is under way
- It does not end until the mission has been finished (which does not mean that it has succeeded, only that nothing more can, or need, be done)
- The traditional division into planning, execution and evaluation is misleading

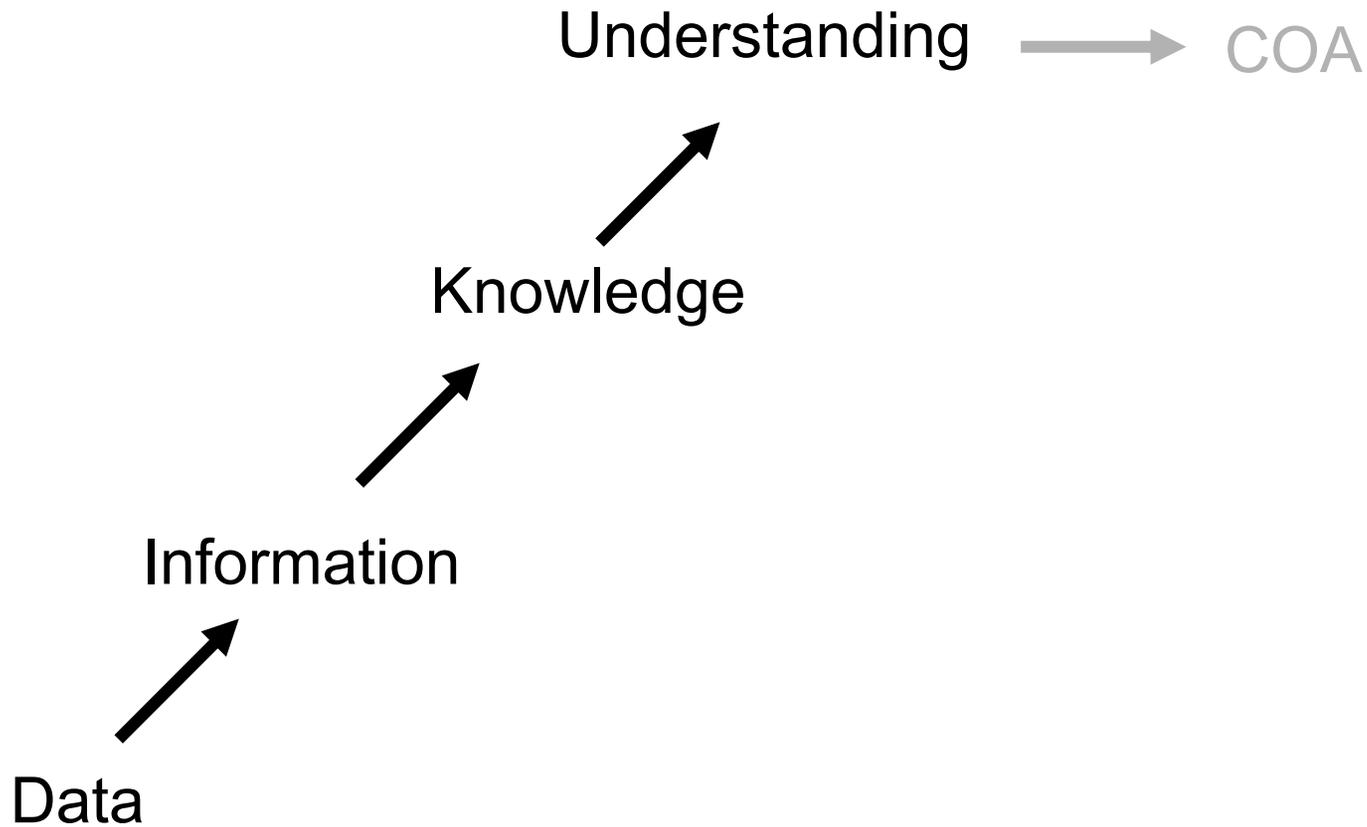
The Three C2 Functions: Sensemaking, Planning and Data Collection

- *Sensemaking*: Produces an understanding of the mission in terms of what needs to be done in the situation at hand → COA
- *Planning*: Elaborates the COA into orders → Orders
- *Data collection*: Acquires the data required for sensemaking. The data are "filtered" by sensors (which may be understood as questions that only provide the data that are asked for. Human sensors are different from technical sensors in this respect)

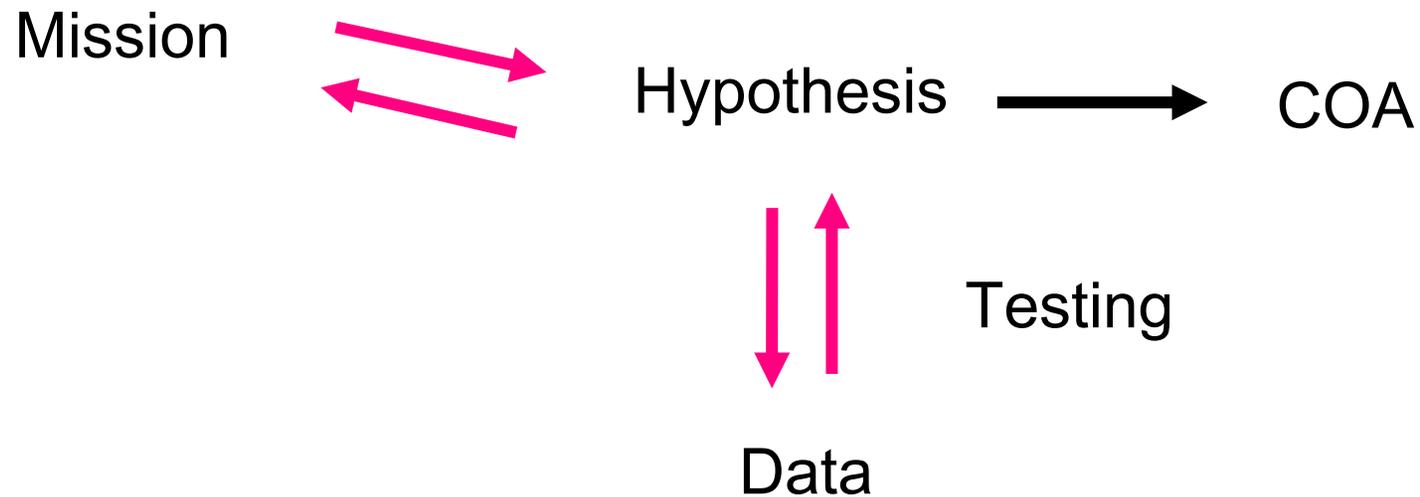
Sensemaking

- We define sensemaking as the function that produces an understanding of the mission *in terms of what should be done* in the situation at hand
- This represents a philosophical commitment to the pragmatism of William James
- We have three reasons
 - Epistemology: Truth is in the consequences
 - Finding a course of action is what C2 is about
 - It provides a useful operationalization

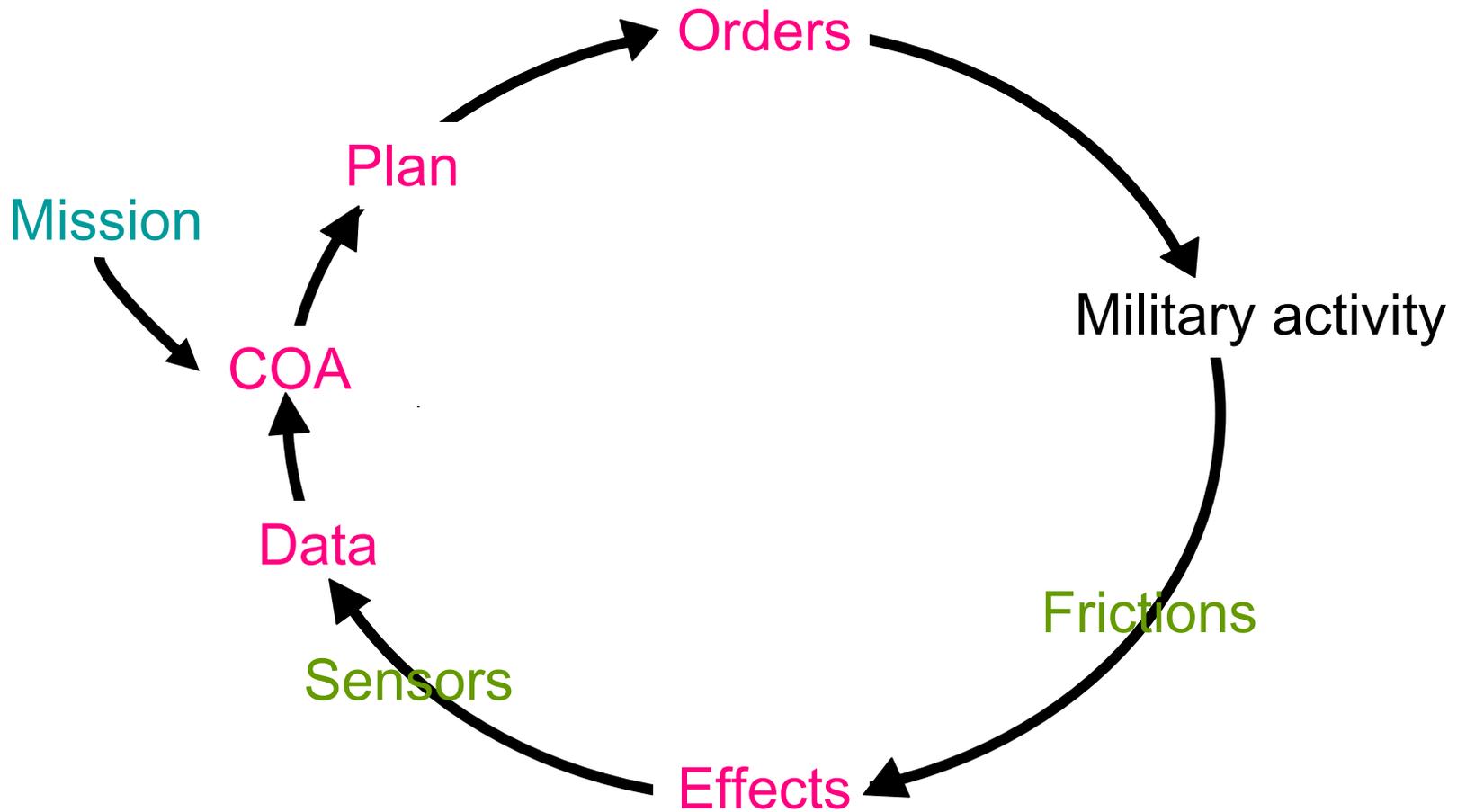
Sensemaking: We reject this model



In favour of this model



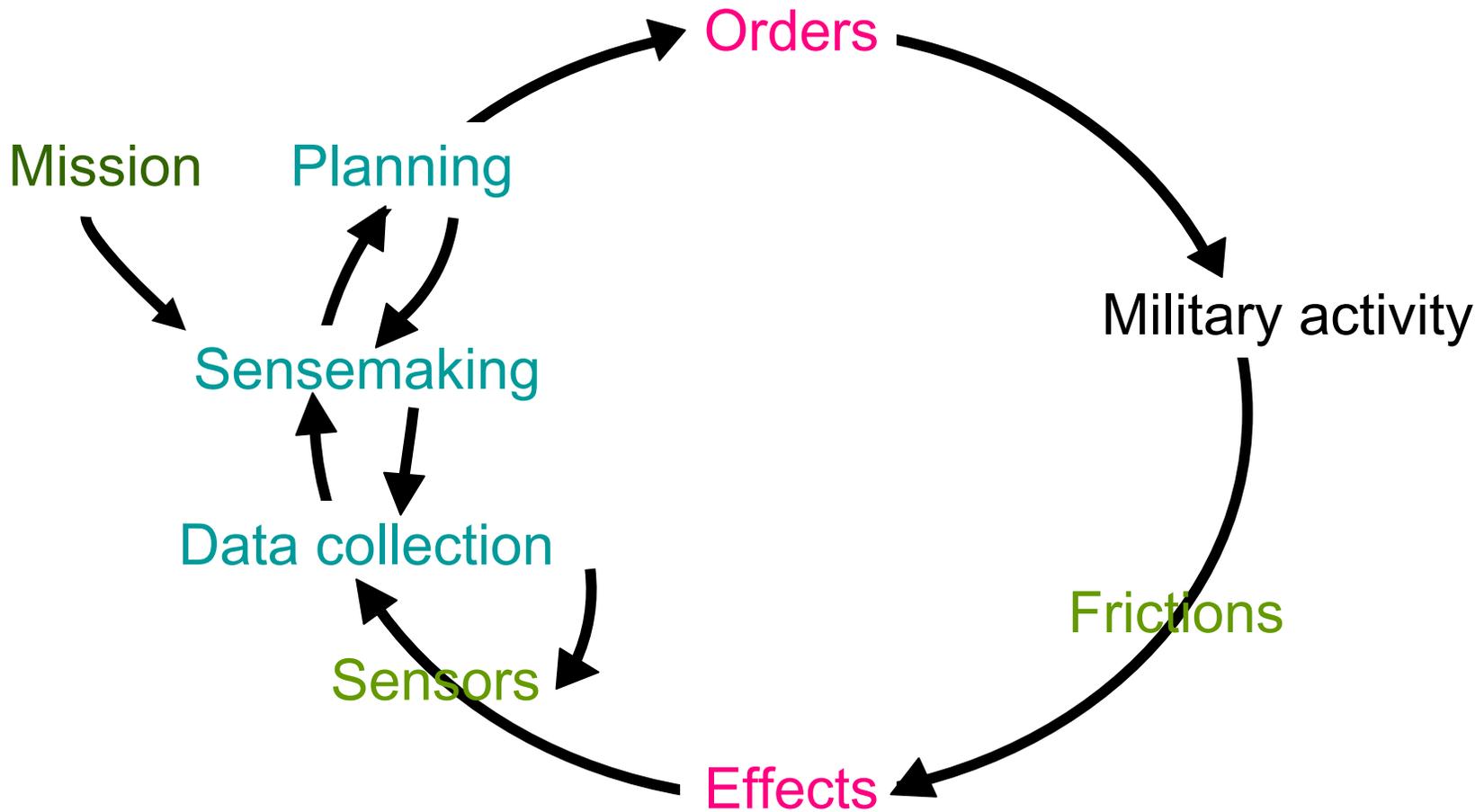
The Product DOODA loop (P-DOODA)



The Process DOODA (Form)

- The Process Loop must be assessed empirically
- Processes that achieve functions may not be neatly separated; there may be a lot of going back and forth
- This makes it hard to achieve an understanding of what is going on and even harder to evaluate it
- The study of processes (form) must therefore be guided by a conception of the functions

The Process DOODA loop



Summary: Purpose, functions, processes and products

Functions reflect our understanding of what the purpose requires

Conceptions of function are used to design processes (including support)

Products are the results of process and can be used to evaluate processes

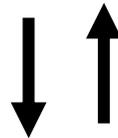
Purpose



Function



Process



Product

The extent to which functions are achieved determines the extent to which the purpose is achieved

Products show the extent to which the purpose and functions are achieved



Empirical Work So Far

- Empirical work must focus on processes and products, functions cannot be studied directly
- We must develop methods for assessing products and characterizing processes
- We have studied the relation between the characteristics of sensemaking as a collective process in a command team and the quality of the plans they produce (presentation by Jensen at this conference)
- We found that an effective sensemaking process is more important than the amount of information that is available to the command teams

Conclusion: The Loop to Rule Them All

- A C2 system can only be fully understood in terms of the functions
- A C2 system will be successful to the extent that it achieves the requisite functions
- A C2 system can be evaluated in terms of the functions
- A C2 system must be designed on the basis on the requisite functions
- Thus, the the loop describing the functions is the most fundamental of the loops that can be constructed
- **It is indeed "the loop to rule them all"**

Thank you

Questions?

Comments?