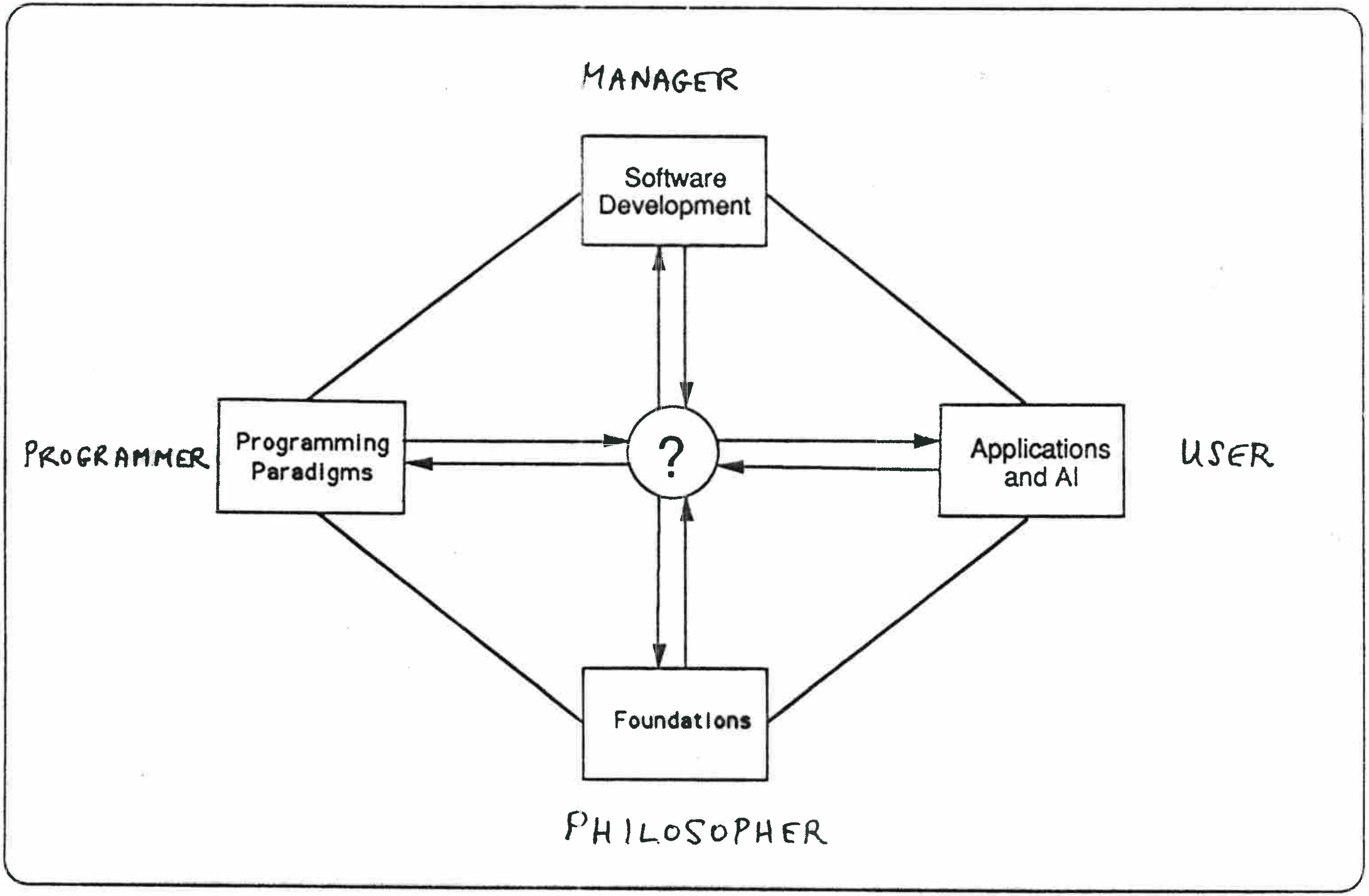

THE FOUR AGENT PERSPECTIVES

Directly relevant issues for this MSc course .....

Programming paradigms

general-purpose parallel programming?

Software development

concurrency and reactive systems

General-purpose parallel programming?

Possible areas for a solution

software **models** hardware

- Consider focus on algorithmic issues too narrow
- My interpretation of model *more* than generalised architecture
- Believe answer lies with modelling in a very general sense
- Relates to paradigms for the programming **process**

Thesis:

Problems of representing state central to parallelism

Why we can't program multiprocessors
the way we're trying to do it now

" ... software technology for [general-purpose] parallel programming is in sad shape .... [this paper places] the blame on the languages in which we are trying to write parallel programs, and even more fundamentally on the models of computation on which those languages are based .... "

Douglas Baldwin

University of Rochester 1987

Concurrent Sequential Processes

" ... no need to distinguish between events initiated by the object and those initiated by some agent outside the object ...avoidance of causality leads to simplification"

C A R Hoare

Baldwin

Why we can't program multiprocessors the way we're trying to do it now

" .... two deep flaws of existing languages:

1) reliance on side-effects,

2) use of iteration or recursion to express data parallelism ..."

Interference in parallel programming

procedural:

"has this variable currently an appropriate value?"

functional:

"is this variable currently defined?"

Ultimate goal for a parallel programming language:

support a clear statement of the data dependencies"

Problems of representing state central to parallelism

Reasons

- if agents are to interact they need knowledge of state
  cf special case of representing user-computer interaction

- strong parallel (!) between problems of state and parallelism

  Two approaches to state / parallelisation in programming

keep implicit	*circumscribe the application*
make explicit	*expose the machine*

Archetypal problem in programming

Functional programming hides state .....
..... *how to represent interaction effectively?*

Object-oriented programming opens up state ....
..... *how to keep conceptual control?*

What of AI and applications? and Foundations?

Many fundamental programming problems
relate to agent interaction:

user / computer

- write programs that are easy to interpret
- write interactive programs that adapt to the user

designer / computer

- integrate requirements analysis with specification
- model CAD where user introduces knowledge gradually

robot / computer

- program a robot to correlate sensory input & internal model

Is it likely that these are all unrelated to problems of general-purpose parallel programming?

Believe that they are all connected.

Themes of the Module

problems of general-purpose parallel programming
bound up with fundamental issues and concepts
in concurrent systems modelling

can't be properly addressed
in the traditional mathematical manner by
"abstracting away from the application"

concerned with relationship between form and content
and content involves real-world illustrations:
the electronic cat- flap, the railway station animation
the room layout, the cricket simulation etc.

get new perspective on programming in general
and parallel programming in particular

BUT – warning!

- won't always directly address
  concurrency / conventional programming

One position, ... the "closed world" paradigm, suggests that all real-world phenomena, the properties and relations of its objects, can ultimately, and at least in principle, be transformed by human cognition into objectified, explicitly stated, propositional knowledge.

The counterposition, ... the "open development" paradigm ... contests the completeness of this knowledge. In contrast, it assumes the primary existence of practical experience, a body of tacit knowledge grown with a person's acting in the world. This can be transformed into explicit theoretical knowledge under specific circumstances and to a principally limited extent only .... Human interaction with the environment, thus, unfolds a dialectic of form and process through which practical experience is partly formalized and objectified as language, tools or machines (i.e. form) the use of which, in turn, produces new experience (i.e. process) as basis for further objectification.