participative systems

http://pangaro.com/PS

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outline

i.   present a hypothesis
ii. sketch a framework
iii. propose a research direction

I.   present a hypothesis

'participants'

act on their own
behave in complex ways that make sense to us
interact with us directly
work with us in achieving our goals
modify their own goals
partner with us in the creation new goals
collaborate with us on the design of new partners

increasingly valuable

hypothesis

interaction framework

to understand existing interactions with participants,
and to propose new and more interesting ones,
we need a framework to characterize degrees of:

autonomy
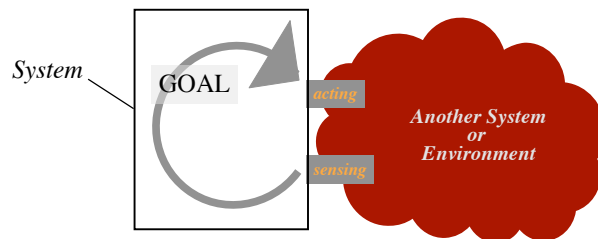complexity
interactivity
collaboration
goal-setting

II.   sketch a framework

defining single-loop and double-loop
characterizing "participative systems"
composing systems of users and artifacts
increasing system variety

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categorizing systems —
single-loop system

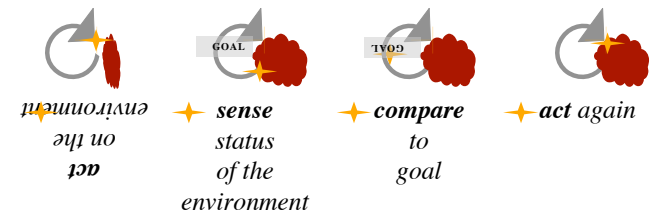*after C Argyris 1992*

can detect and react / has goals that are static

thermostat senses temperature below 70°f
setpoint and turns on heat

System GOAL *acting* *sensing* *Another System or Environment*

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single-loop cycle

*act on the environment* ✦ *sense status of the environment* ✦ *compare to goal* ✦ *act again*

2

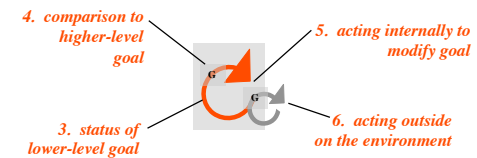## categorizing systems — double-loop system

after C Argyris 1992

can detect and react on multiple levels

    system can sense from outside itself

    system can also sense the status of its lower-level
      goal: is it achieved, how closely, for how long…

1. sensing outside

2. sensing status of lower-level goal
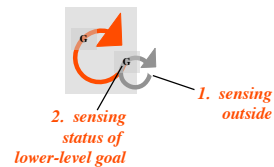
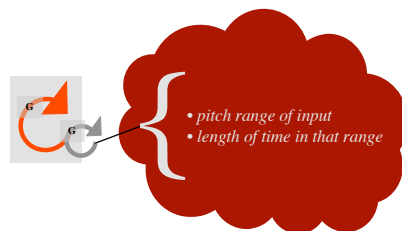## categorizing systems — double-loop system

has goals that are dynamic and changeable

    system compares status of lower-level goal to higher-level

    higher-level goal may take action to modify lower-level goal

    this new goal causes actions to be taken outside

4. comparison to higher-level goal

5. acting internally to modify goal

3. status of lower-level goal

6. acting outside on the environment

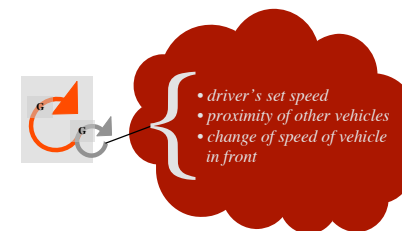## categorizing systems — double-loop system

Pask's Musicolour

    avoids boredom [second-order goal]

    by varying mapping of sound to light [first-order goal]

    in response to changing inputs from musician

• pitch range of input
• length of time in that range

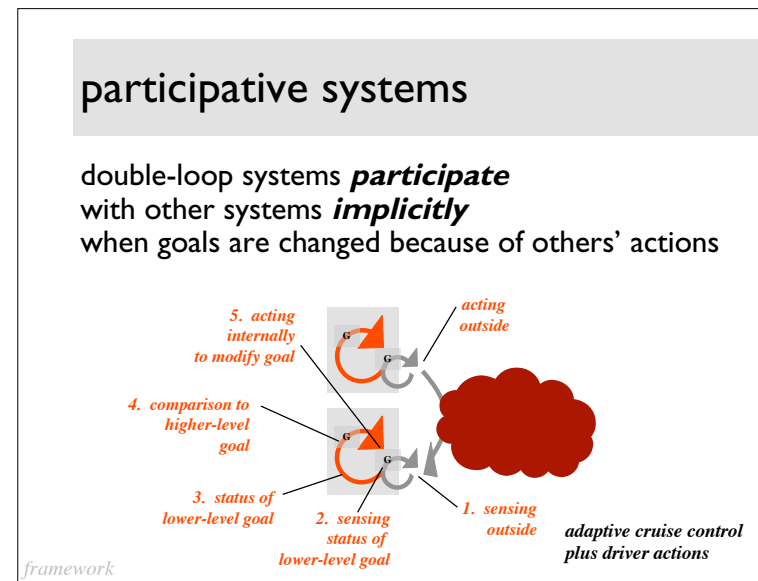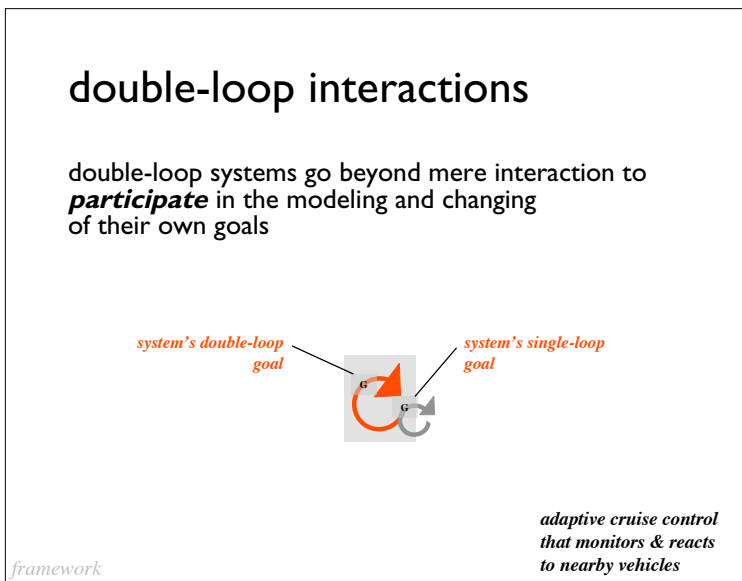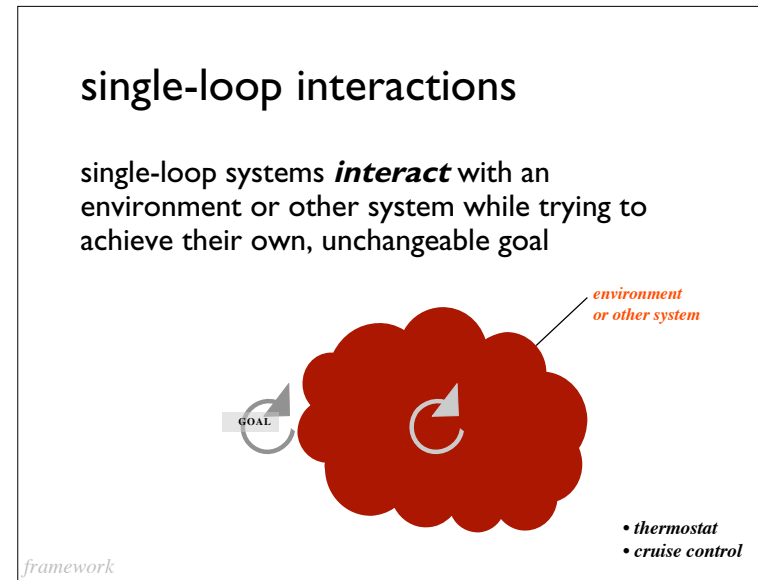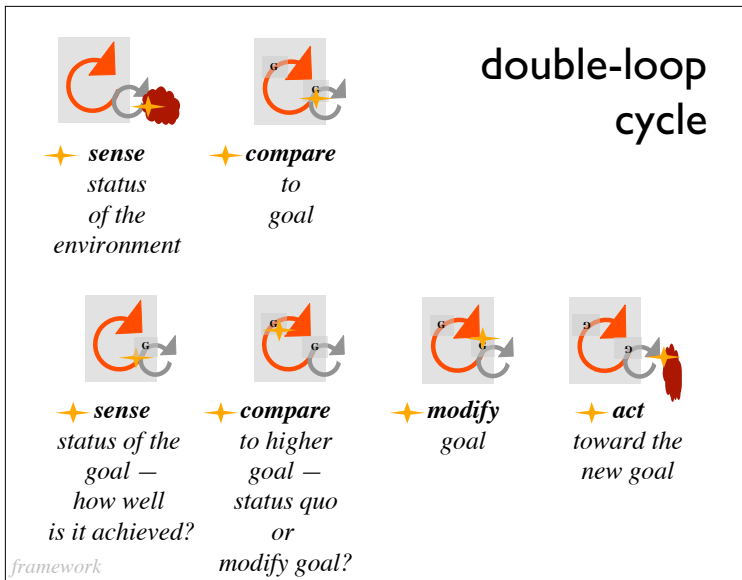## categorizing systems — double-loop system

adaptive cruise control

    avoids collisions with vehicles [second-order goal]

    by varying `Set` cruising speed [first-order goal]

    in response to changing speed of vehicles in front

• driver's set speed
• proximity of other vehicles
• change of speed of vehicle in front

3

double-loop cycle

sense *status of the environment*

compare *to goal*

sense *status of the goal — how well is it achieved?*

compare *to higher goal — status quo or modify goal?*

modify *goal*

act *toward the new goal*

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single-loop interactions

single-loop systems ***interact*** with an environment or other system while trying to achieve their own, unchangeable goal

environment or other system

GOAL

• *thermostat*
• *cruise control*

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double-loop interactions

double-loop systems go beyond mere interaction to ***participate*** in the modeling and changing of their own goals

system's double-loop goal

system's single-loop goal

adaptive cruise control that monitors & reacts to nearby vehicles

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participative systems

double-loop systems ***participate*** with other systems ***implicitly*** when goals are changed because of others' actions

5. acting internally to modify goal

acting outside

4. comparison to higher-level goal

3. status of lower-level goal

2. sensing status of lower-level goal

1. sensing outside

adaptive cruise control plus driver actions

participative systems

double-loop systems may **participate explicitly**
with other double-loop systems in goal-setting
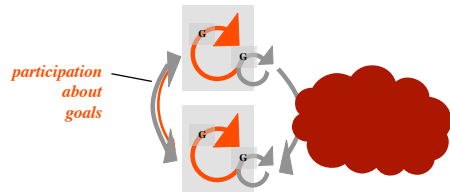
*participation
about
goals*

participative systems — definition

modify themselves as a result of interactions

participate in changing their goals

influence other double-loop systems to test and
modify their goals

participate in the creation of new possibilities

only double-loop systems are participative
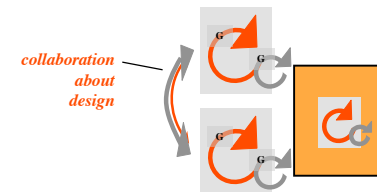
participative systems — collaboration

when double-loop systems interact with other
double-loop systems for the **same** goals,
they **collaborate** with each other
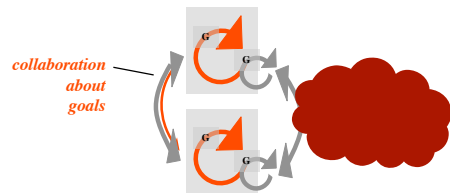
*collaboration
about
goals*

participative Systems — design

when double-loop systems collaborate to create
new systems, they engage in design

*collaboration
about
design*

composing a system — human user

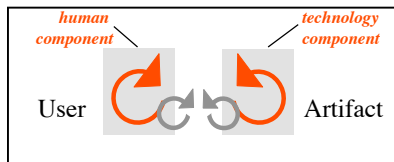a human User may behave as a single- or double-loop system

composing a system — technological artifact

an Artifact may be a single- or double-loop system

composing systems — humans and technology

User may be single- or double-loop sub-system
Artifact may be single- or double-loop sub-system

variation 1

User and Artifact are each single-loop

User and Artifact
   act and sense
   pursue a fixed goal
   do not change the
      goals of the other

6

only user is double-loop

User
 modifies own goals
 can delegate to the
   artifact to achieve
   own [user's] goals

 guides the whole

User Artifact

Artifact
 acts and senses
   according to a
   fixed goal

framework

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only Artifact is double-loop

User
 acts and senses
   according to a
   fixed goal

Artifact

User Artifact

 modifies own goals
 can delegate to the
   user to achieve its
   [artifact's] goals
 guides the whole

framework

User and Artifact each double-loop
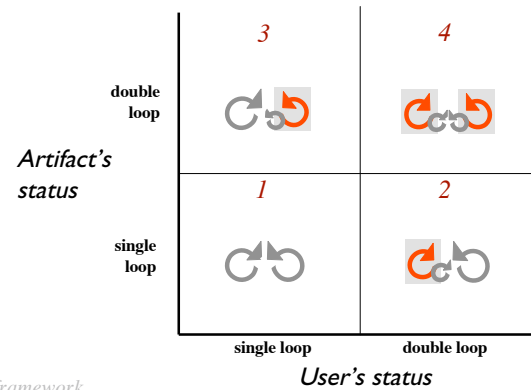
User and Artifact
 contain models of
   their goals
 vary their goals
 delegate to the other

User Artifact

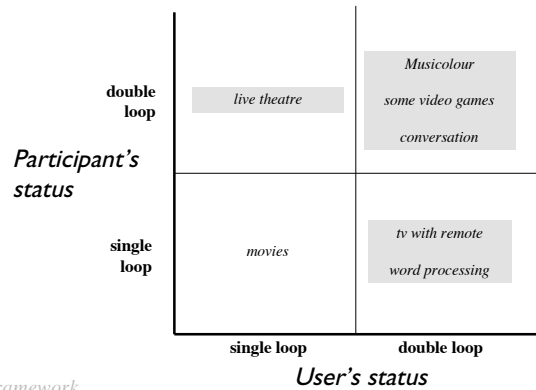 may influence the
   goals of the other

framework

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space of participative systems

Artifact's status — User's status

	single loop	double loop
double loop	3	4
single loop	1	2

framework

7

system variations — interactive media

Participant's status		
double loop	*live theatre*	*Musicolour* / *some video games* / *conversation*
single loop	*movies*	*tv with remote* / *word processing*
	single loop	**double loop**

User's status

system variations — summary

Artifact's status	*3*	*4*
double loop	*user is **passive*** / *artifact is **leading***	*user may be **collaborating with** the artifact* / *the artifact may be **a design partner***
single loop	*user is **functioning as if an artifact*** / *artifact is **the user's peer***	*user **uses the artifact** as a tool* / *artifact is **passive***
1	**single loop**	**double loop** *2*

User's status
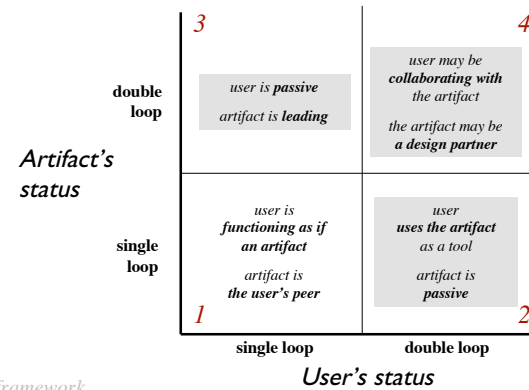
increasing system variety — single-loop

increasing complexity

Participant's status

double-loop

single-loop

increase in capacity of the Artifact to respond to complex conditions — more variables tracked, and more possible responses, but goals are fixed
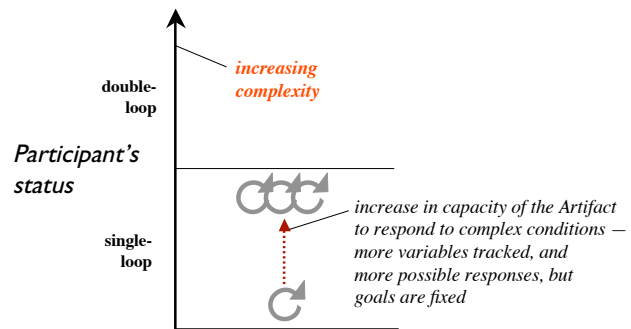
increasing system variety — transition to double loop

Participant's status

double-loop

single-loop

transition from ability to respond to ability to reflect on response — and therefore modify goals
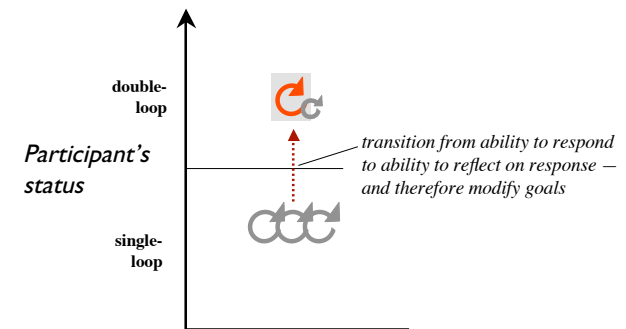
increasing system variety — double-loop

double-loop

Participant's category

single-loop

increase in capacity to reflect on possible responses — more complex models of own goals, and more complex ways to modify its goals

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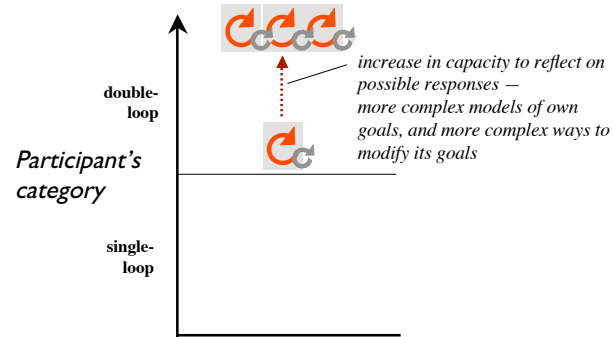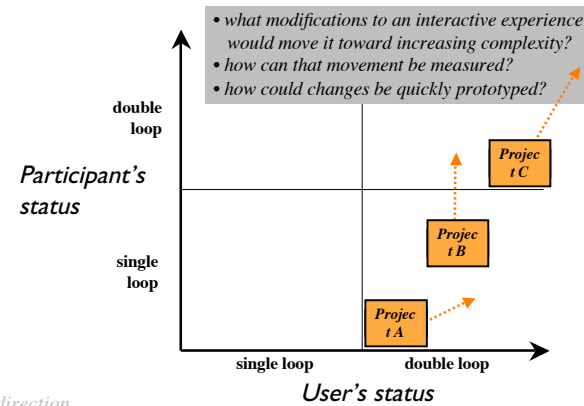
categorize current research
propose research metrics
design demo architecture
formulate initial questions

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categorize interactive systems

double loop

Participant's status

single loop

• *use the framework to characterize & compare*
• *refine the framework*

Projec t C

Projec t B

Projec t A

single loop   double loop

User's status

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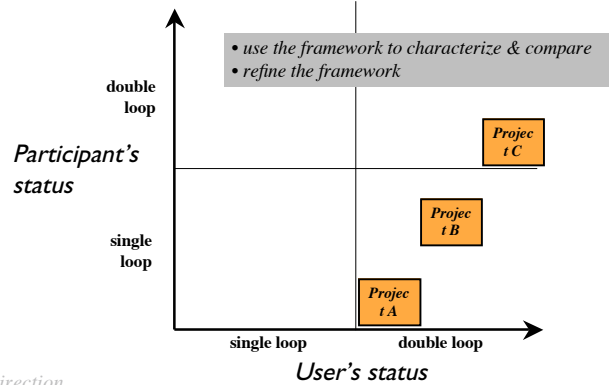
propose interactivity metrics

double loop

Participant's status

single loop

• *what modifications to an interactive experience would move it toward increasing complexity?*
• *how can that movement be measured?*
• *how could changes be quickly prototyped?*

Projec t C

Projec t B

Projec t A

single loop   double loop

User's status

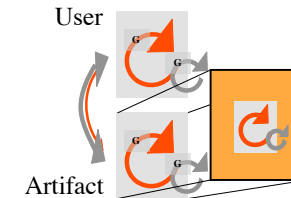## collaboration architecture — User+Artifact does design

Users and Artifacts can collaborate on the construction of new demos

User
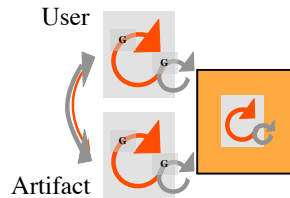
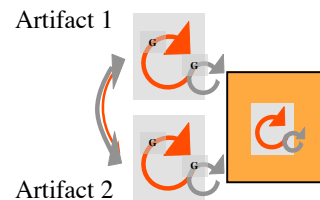Artifact

designing new systems

new demo under design may be the next-generation Artifact

User

Artifact

Artifact+Artifact does design

it should be possible to create collaborating artifacts that construct new systems

Artifact 1

Artifact 2

two broad application domains

participative systems in environmental controls
- monitoring and improving quality of air and water
- control and coordination of audio and video information sources, including radio, telephone, voicemail, video, broadcast media

participative systems in user experience design
- monitoring and improving the quality of our daily use of software
- control and coordination of digital information sources, including email and web

initial questions — environmental controls

what environmental sensors are currently available?
- focus on air, water, sound
- include a wide range of sensor types
- consider needs for accuracy, bandwidth, low power

what control systems effect reduced costs?
- energy management
- healthcare management

what control systems improve human comfort?
- hvac, toxins, …

initial questions — user experience design

how does this framework apply to pure software systems?

- software monitors can maintain overall system health of networks and distributed software applications
- autonomous software agents can forage the internet to find information and potential relationships
- bug wizards can detect, diagnose, and correct user errors and system bugs

initial questions — how are goals to be represented?

requirements
- single-loop systems must be able to test a goal against sensor data
- double-loop systems must be able to modify its single-loop goal(s)

range of representations should be explored
- symbolic data structures…
- configurations of a neural net…
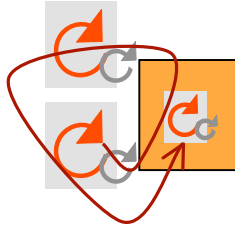- genetic algorithms…

summary goals for participative systems

encompass complexity, collaboration, and goal-directed systems in a single framework

provide a framework to characterize, compare, and extend any given product or service

propose a means to construct collaborative design partners

participative design

participative design