





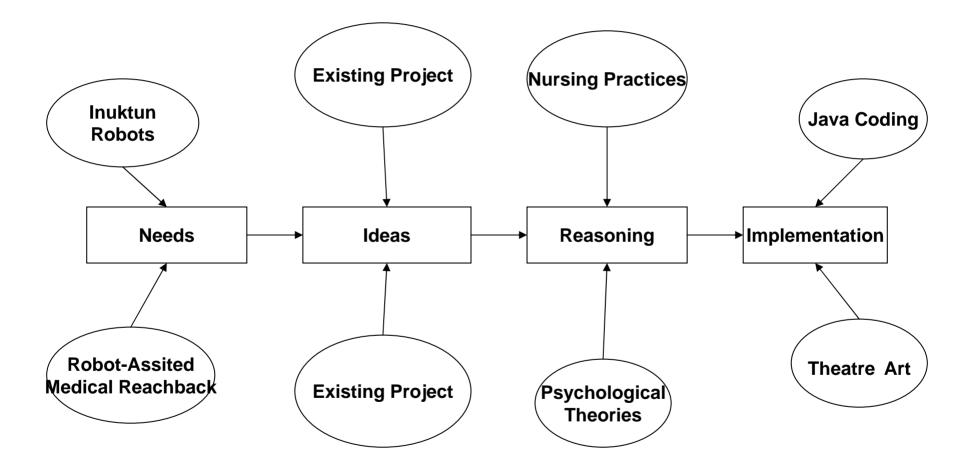
#### An Affective Marsupial Team For Robot-Assisted Medical Reachback

Van T. Phu New Jersey Institute of Technology

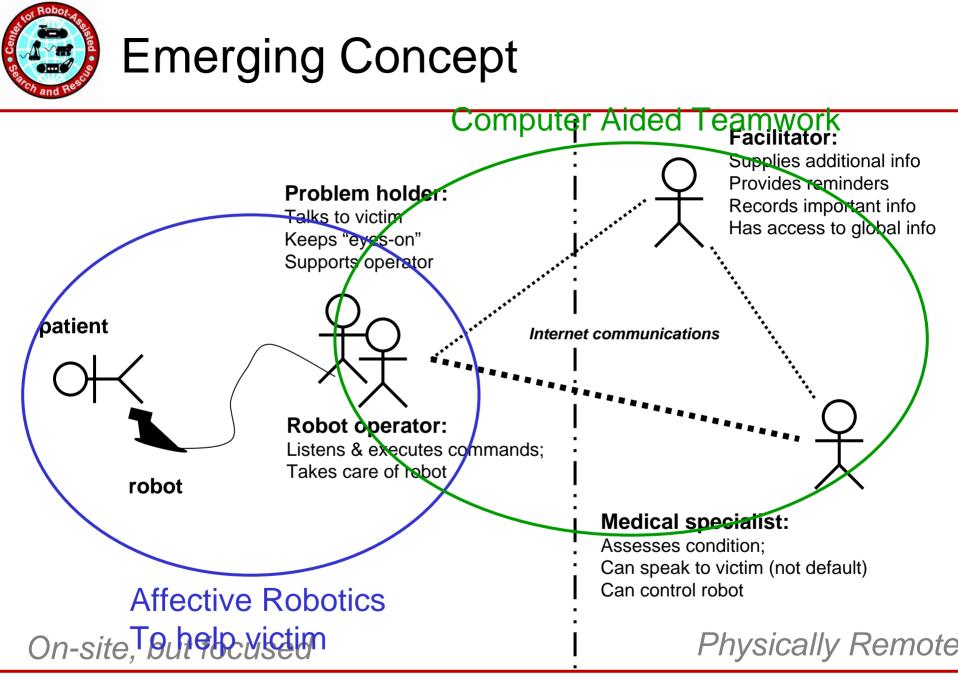
PI: Prof. Robin R. Murphy, Director Center for Robot-Assisted Search and Rescue Portions of this work are funded in part by DARPA & CRA-W



#### **Project Overview**







USF UNIVERSITY OF south FLORIDA research • deploy • train • evaluate



- Robots are teleoperated now but require too much concentration to make the robots move (and look) less creepy to the patients and be more comforting
  - Program guarded motions and expressive motions
- Option 1: use only the robot platform
  Disadvantage, lose eye-contact, function overrides form
- Option 2: create a second device that rides on the robot that can be more expressive (marsupialism)





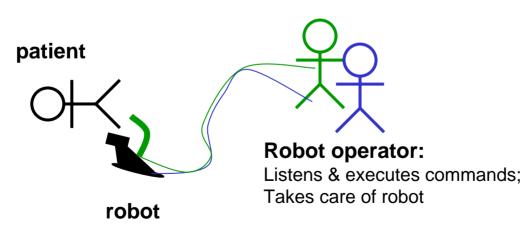
## Buddy device

 Buddy device to ride on platform and be controlled by problem holder

– Kerrebrock's mini-snake? Orbit webcam?



Talks to victim Keeps "eyes-on" Supports operator







# Control: More Animatronic than Autonomous

- Operator controls the buddy
  - Provides the "perception"
- Operator picks the desired affect
  - Tactical behaviors make sure the motions/pose/etc. fit the affect; take burden off the operator
- Later work
  - Coordinating marsupial team
  - Robot track victim





- Affective computing
  - Breazeal and Brooks (2004) presents the continuous dimensions (valence, arousal and stance) of the basis emotions which include fear, anger, surprise, tired, happy, unhappy, sorrow, disgust, accepting, stern, sorrow and calm.
- Picard suggested in the <u>Affective Computing</u> three categories of emotions:
  - Prospect
  - Confirmation
  - Fortunes-of-others



## Literature Review (cont.)

- Categories of affective robots
  - Avatar
    - a computer screen displays face on robot, but no real motion or pose conveyed
  - Head or Face Only
    - No body or body does not express any affect
  - Body
    - Body also explicitly expresses affect
- Primarily interested in Body, since have a faceless snake



## **Relevant Projects**

| Name       | With face? | Affective motions   |
|------------|------------|---|
| Anemone    | No         | Rapidly reverse, reach towards, sway                                |
| Roco       | No         | Yes with head, yes with body, no with head, no with body, quizzical |
| Care-O-Bot | Yes        | Attention, yes, no  |
| Arnold     | Yes        | Yes, no   |
| Wakamaru   | Yes        | Yes, no   |
| Pearl      | Yes        | Yes, no   |
| Kismet     | Yes        | Attention, turn away, withdrawal, startle, tracking                 |
| Flo        | Yes        | Yes, no, attention  |





## Most Similar

| Name    | With face? | Affective motions   |
|---------|------------|---|
| Anemone | No 🔶       | Rapidly reverse, reach towards, sway                                |
| Roco    | No 🔶       | Yes with head, yes with body, no with head, no with body, quizzical |
| Kismet  | Yes        | Attention, turn away, withdrawal / startle, tracking, calm          |
| Flo     | Yes        | Yes, no, attention  |





## What are the motions that are generated? Can We Do Them?

|   | Expression   | Motion/Pose            | Snake could |
|---|--------------|------------------------|-------------|
| 1 | Fear         | Reverse direction fast | same        |
| 2 | Interest     | Move towards           | same        |
| 3 | Normal/happy | sway                   | same        |
| 4 | yes          | Body bend              | same        |
| 5 | yes          | "top" bend             | ?           |
| 6 | no           | Body sway              | same        |
| 7 | no           | "top" sway             | ?           |
| 8 | quizzical    | Sideways, diagonal     | ?           |





### Selected emotions

- Agree: rotate from left and right and reverse
- Disagree: bend down and then up
- Attention: like Yes, but slower
- Happy: rotate around while bend down and up with rhythm
- Surprise: rapidly bend up
- Empathy: like Attention but slower
- Sorrow: slightly rotate from left to right and reverse
- Content: unchanged in neither rotate or bend

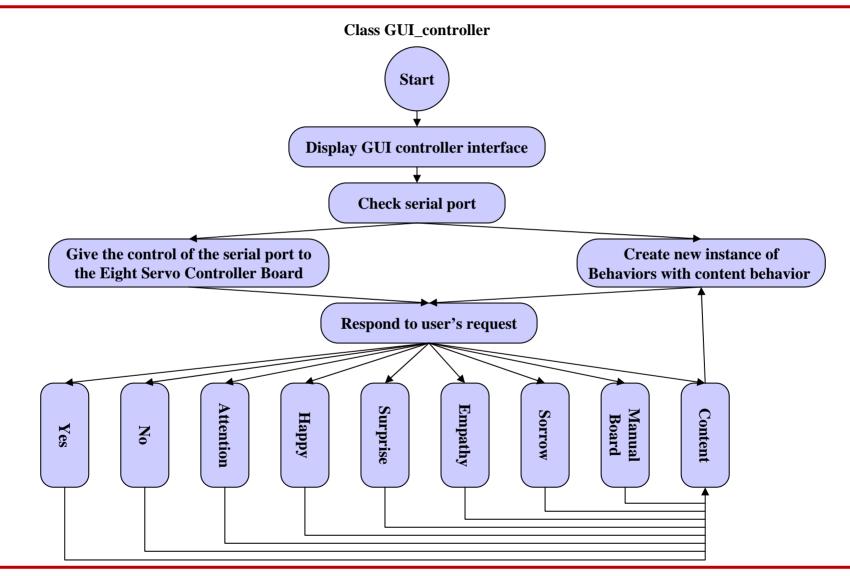


- The serial control technique uses Java Communication API (very much similar to that of the Inuktun's).
- GUI is carried out using GUI Building features in NetBeans IDE 3.6
- The robot's behaviors were built with feedbacks from puppetry experts.



## URL Dynamic Model

USF UNIVERSITY OF SOUTH FLORIDA





## **URL Class Diagram**

| GUI_controller   |
|--|
| spc: EightServoSerialPortControl<br>sctr: Behaviors<br>inStreamReader: InputStreamReader   |
| InstreamkeaderYesButtonMouseClicked()NoButtonMouseClicked()AttentionButtonMouseClicked()HappyBottonMouseClicked()SurpriseButtonMouseClicked()EmpathyButtonMouseClicked()SorrowButtonMouseClicked()ContentButtonMouseClicked()DownRightButtonMouseClicked()DownRightButtonMouseClicked()DownLeftButtonMouseClicked()DownCenterButtonMouseClicked()CenterRightButtonMouseClicked()CenterRightButtonMouseClicked()CenterRightButtonMouseClicked()CenterRightButtonMouseClicked()CenterRightButtonMouseClicked()CenterLeftButtonMouseClicked()CenterButtonMouseClicked()centerButtonMouseClicked()centerButtonMouseClicked()main() |
|  |





## URL Class Diagram (cont.)

| EightServorControl   |   | Behaviors   |
|--|---|---|
| portId: CommportIdentifier<br>serialPortList: Enumeration<br>inputStream: InputStream<br>outputStream: OutputStream<br>serialPort: SerialPort<br>readWriteThread: Thread<br>responsePacket: byte[] |   | No_List: byte[]<br>Yes_List: byte[]<br>Attention_List[]<br>Happy_List[]<br>Surprise_List[]<br>Empathy_List[]<br>Sorrow_List[] |
| run()<br>serialEven()<br>senCommand()<br>getresponsePacket()<br>clearStream()  |   | Agreed() Disagreed()<br>Happy() Content()<br>Surprise() Sympathy()<br>Sorrow() Empathy()                                      |
|  | 1 | Snake_control   |
|  |   | Send_packet[3]<br>Channel<br>ServoNum<br>position   |
|  |   | createControlPacket()<br>Bend()<br>Rotate()<br>Unchaged_rotate()<br>Unchanged_bend()  |





### **Graphical User Interface**







#### **Final Product**



