The Curious Guide: Social Interaction Design for Sphero

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Submission Checklist

- Written description of intended behavior (this document)
- All code (see §5)

1 Concept Overview

Concept. *The Curious Guide*: Sphero co-locates attention on a target object (e.g., a red cup), communicates using nonverbal cues and brief speech, and plays a turn-taking game with the human.

New behavior extensions.

- **Voice listening** (*verbal + nonverbal*): Sphero shows an "ear" (tail LED + attentive color) and opens a short listening window, then replies by voice.
- **Hit reaction** (*touch/haptics + social navigation*): When struck during motion, Sphero says "Ouch!" and either *shakes* or *runs away* briefly in a random direction.

2 Mapping to Requirements

Verbal + Nonverbal
Spoken prompts (`speak`) + LED color states, tail pointing, motion patterns.

Deixis
Robot turns to face the object and illuminates the tail LED to point.

Joint Attention
Brief fixation (≈ 650 ms) before speaking, to allow human co-orientation.

Turn-taking
The robot waits for a human *tap* to proceed at two points in the interaction.

Includes 5/7 expressed by robot

- **Gaze**: orientation and fixation.
- **Gesture**: nod (forward/back pulses).
- **Proxemics**: approach to arm's length; brief retreat on bump.
- **Social navigation**: polite apology + route-around after collisions.
- **Posture**: idle "breathing" vs. attentive color.

Recognized (1/7)
Touch: tap/collision detection while stationary.

3 Interaction Script and Timing

Script

S1: Greet. Idle blue; "Hi, I'm Spot. Tap me when you're ready."
S2: Voice Cue. Shows "ear" (tail LED + warm color), listens for ≈ 3 s, replies: "I heard you. Hi!"
S3: Deixis. Faces object, tail points, nods, says "Look over there."
S4: Proxemics. Rolls forward to arm's length.
S5: Turn-taking. Prompts for another tap; waits.
S6: Social Navigation. Says "Excuse me, going around." and executes a side-step path.
S7: Celebrate. Happy color; "We did it! End of run."

Timing Rationale

- **Fixation** ≈ 650 ms for joint attention.
- **Tap polling** every 100 ms for responsive turn-taking.
- **Gestures** 180 ms pulses; crisp but readable.
- **Listening window** 3 s to pace human speech without dragging.
- **Run-away** 1.0 s burst to be readable on video but safe in small spaces.

4 Implementation Details

Voice Listening (limitations). Sphero Edu Python does not expose a microphone API; therefore "hearing voice" is implemented as a *designed listening moment*: the robot displays an ear-like cue and verbally invites speech, then acknowledges verbally after a short listening window. This preserves the social *affordance* of being listened to, even though detection is simulated. (With RVR + laptop Python, full speech recognition can be added; omitted here to keep the EDU environment.)

Hit Reactions. Collisions while stationary count as turn-taking taps. Collisions while moving trigger a reactive branch: *shake* (rapid forward/back pulses) or *run-away* (random heading burst). Both produce the verbal interjection "Ouch!" or "Yikes!" for affect.

Safety. Speeds and durations are bounded; headings quantized to six spokes to avoid tight spins; verbal apologies precede route-around motion.

5 Code

Main Program (EDU Python)

```
# Paste the full program you ran here (same as delivered in chat).
# If you keep it in a separate file, replace this block with:
# \lstinputlisting{curious_guide_voice_hit.py}
```

6 Design Review Talking Points

- How deixis + fixation establish joint attention before speech.
- Why 650 ms fixation and 3 s listening window support human timing.
- Touch as the recognized channel; potential extensions (speech recognition with RVR).
- Social navigation: apology + route-around and why it reads as polite.

7 Limitations & Future Work

- Real voice input using offboard ASR (laptop/phone) feeding back to the EDU program.
- BOLT matrix icons for richer nonverbal expressions (ears, faces).
- Multi-party turn-taking and dynamic proxemics (e.g., different approaches for seated vs standing users).