Designing Ambient Narrative-Based Interfaces to Reflect and Motivate Physical Activity

Elizabeth L. Murnane, Xin Jiang, Anna Kong, Michelle Park, Weili Shi, Connor Soohoo, Luke Vink, Iris Xia, Yu Xin, John Yang-Sammataro, Grace Young, Jenny Zhi, Paula Moya, James A. Landay
Physical inactivity is a global epidemic
Personal technology could help tackle immobility

- low cost
- continuously available
- personalized
- scalable
Health apps already abound... 
... but aren’t doing the trick
Many people find conventional, **quantitative** feedback confusing and overwheming.
Many people find conventional, **quantitative** feedback **distressing** and **demotivating**
**Stories** are engaging, rich, relatable – and a powerful motivational technique
Narrative-based, glanceable feedback reflects a user’s physical activities and progress towards goals.
Narrative-based, glanceable feedback reflects a user’s physical activities and progress towards goals.
Activity Tracking and Goal Setting
Activity Tracking and Goal Setting
Activity Tracking and Goal Setting

[Diagram showing the integration of mobile devices, wearable devices, and web browsers with Google Fit APIs for activity tracking.]
Activity Tracking and Goal Setting
Real-Time Positive Feedback

20% - Zuki scans the control panel. “Aha!” The propellants aren’t providing enough power.

40% - Zuki is looking for the appropriate control to fix the problem.

60% - “Great! That’s the button!” Zuki presses it.

80% - The red light stops flashing. Zuki breathes easy.

100% - Outside the round window, Zuki sees Earth and smiles. “I’m here!”
Real-Time Positive Feedback

Logged activities are represented as thematically relevant icons
Real-Time Positive Feedback

Logged activities are represented as thematically relevant icons

- Icon color = activity type
- Icon size = activity duration
Real-Time Positive Feedback

Achievement towards goals reflected by
• Progress indicator
Real-Time Positive Feedback

Achievement towards goals reflected by
• Progress indicator
• Story advancement
13 chapters, to support a multi-month experience
Episodic structure
Characterization
Dramatic saga
Episodic structure
Characterization
Dramatic saga
Episodic structure
Characterization
Dramatic saga
Episodic structure
Characterization
Dramatic saga
Episodic structure
Characterization
Dramatic saga
Episodic structure
Characterization
Dramatic saga

antagonist
Episodic structure
Characterization
Dramatic saga
Narrative has powerful, lasting effects on attitude and behavior

- Narrative Transportation Theory
- Extended Elaboration Likelihood Model
- Entertainment Overcoming Resistance Model
Iterative user-centered design

- Low-fi testing
- Paper prototypes
- Sketches exploring potential plots
- Storyboards of early concepts
- Progressively higher fidelity digital interfaces
Designing Ambient Narrative-Based Interfaces to Reflect and Motivate Physical Activity

Elizabeth J. Macewan, Xia Jiang, Anna Kong, Michelle Park, Wei Yi, Connor Scobie, Marina Venable, Yu Zhu, Yi Xia, Jia Xie, Yang Sasmatsaroj, Grace Hung, Joon Yi, Paige Yang, Jenice A. Landay

http://hci.st/zuki-chi2020
Design takeaways

- Visuals vs. text
- Emotional richness
- Thematic coherence
Let the visuals do the talking
Let the visuals do the talking

Key features & strategies:

• Minimal text / plot to be comprehensible through visuals alone
Let the visuals do the talking

Key features & strategies:

• Minimal text / plot to be comprehensible through visuals alone
• Glanceable interface
Let the visuals do the talking

Key features & strategies:

• Minimal text / plot to be comprehensible through visuals alone
• Glanceable interface & avoiding occlusion
Let the visuals do the talking

Key features & strategies:

• Minimal text / plot to be comprehensible through visuals alone

• Glanceable interface & avoiding occlusion
Let the visuals do the talking

Key features & strategies:
• Minimal text / plot to be comprehensible through visuals alone
• Glanceable interface & avoiding occlusion
• Obvious visual markers of progress
• Celebratory icons
Emotional attachment is a must
Emotional attachment is a must

Key features & strategies:
• Empathy-building backstory
Emotional attachment is a must

Key features & strategies:
• Empathy-building backstory
• Excitement and suspense
Emotional attachment is a must

Key features & strategies:

- Empathy-building backstory
- Excitement and suspense
- Preference for chapters incorporating additional archetypal characters (antagonists, sidekicks)
Narrative experience needs to be coherent
Narrative experience needs to be coherent

Key features & strategies:
- Logical connection between story and personal goals
Narrative experience needs to be coherent

Key features & strategies:
• Logical connection between story and personal goals
• Preference for chapters with Zuki showing exertion
Narrative experience needs to be coherent

Key features & strategies:
- Logical connection between story and personal goals
- Preference for chapters with Zuki showing exertion
- Thematic & aesthetic consistency within & across chapters
Narrative experience needs to be coherent

Key features & strategies:

• Logical connection between story and personal goals
• Preference for chapters with Zuki showing exertion
• Thematic & aesthetic consistency within+across chapters
• Even small design details can make or break experience
What happens when people engage with Zuki in daily life?
Pilot deployment

Small-scale sample
- N=16
- 10 female, 6 male
- 18-75 (median 34) years old

3 week field trial
- In-person entry and exit interviews
- Pre, post, daily, weekly surveys
- Logs of exercise and app use
Pilot deployment

Small-scale sample
• N=16
• 10 female, 6 male
• 18-75 (median 34) years old

3 week field trial
• In-person entry and exit interviews
• Pre, post, daily, weekly surveys
• Logs of exercise and app use
Study groups

• Between-subjects, 2 X 2 design (4 conditions)
• Chapter length (multi/single) X Notifications at 20% milestones (y/n)

Multi-chapter condition

Single-chapter condition

UbiFit (Consolvo et al.),
UbiGreen (Froehlich et al.)
Deployment findings

Exercise

Engagement
Deployment findings

Exercise

Engagement
More physical activity observed in participants with the multi-chapter story
More physical activity observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

- **set and achieved more, harder goals**
- logged more activities
- maintained activity levels throughout the study (more minutes, more often, even in final week)
More physical activity observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

- set and achieved more, harder goals
- logged more activities
- maintained activity levels throughout the study (more minutes, more often, even in final week)

81.6% automatic
18.4% manual
1065 total activities logged
More physical activity observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

- set and achieved more, harder goals
- **logged more activities**
- maintained activity levels throughout the study (more minutes, more often, even in final week)
More physical activity observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

- set and achieved more, harder goals
- logged more activities
- maintained activity levels throughout the study (more minutes, more often, even in final week)
Positive psychological shifts observed in participants with the multi chapter story
Positive psychological shifts observed in participants with the multi-chapter story

- Half of multi-chapter participants advanced at least one behavior change stage

- Readiness and self-efficacy to improve behavior remained unchanged or diminished for single-chapter participants

- Starting stage affects need for emotional vs. instrumental support (e.g., “I need more data, rather than the story. I needed the numbers and charts.”)
Positive psychological shifts observed in participants with the multi-chapter story

- Half of multi-chapter participants advanced at least one behavior change stage

- **Readiness and self-efficacy to improve behavior remained unchanged or diminished for single-chapter participants**

- Starting stage affects need for emotional vs. instrumental support (e.g., “I need more data, rather than the story. I needed the numbers and charts.”)
Positive psychological shifts observed in participants with the multi-chapter story

• Half of multi-chapter participants advanced at least one behavior change stage

• Readiness and self-efficacy to improve behavior remained unchanged or diminished for single-chapter participants

• Starting stage affects need for emotional vs. instrumental support (e.g., “I need more data, rather than the story. I needed the numbers and charts.”)
Deployment findings

- Exercise
- Engagement
More engagement with the display observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

- glanced more at their ambient story display throughout the study
- reported sustained interest in periodically checking on Zuki (e.g., “just to see how he is, what he’s doing”)
More engagement with the display observed in participants with the multi-chapter story

Participants who received the multi-chapter narrative...

• glanced more at their ambient story display throughout the study

• reported sustained interest in periodically checking on Zuki (e.g., “just to see how he is, what he’s doing”)
More narrative engagement observed in participants with the multi-chapter version

<table>
<thead>
<tr>
<th></th>
<th>Single</th>
<th>Multi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empathy</td>
<td>11.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Ease of Cognitive Access</td>
<td>10.6</td>
<td>10.9</td>
</tr>
<tr>
<td>Cognitive Perspective Taking</td>
<td>18.8</td>
<td>19.6</td>
</tr>
<tr>
<td>Involvement</td>
<td>15.4</td>
<td>18.3</td>
</tr>
<tr>
<td>Realism</td>
<td>9.6</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Narrative Engagement Scale
(Busselle & Bilandzic, 2009)
Deployment findings

Exercise

Engagement
Where is Zuki headed next?
Opportunities and future work

- Longitudinal deployments (months-long, large N, vs. conventional feedback)
- Narrative-centric design (other literary devices, specific populations)
- Developing “smarter” stories (proactive, interactive, personalized)
Opportunities and future work

• Longitudinal deployments (months-long, large N, vs. conventional feedback)
• **Narrative-centric design (other literary devices, specific populations)**
• Developing “smarter” stories (proactive, interactive, personalized)
Opportunities and future work

- Longitudinal deployments (months-long, large N, vs. conventional feedback)
- Narrative-centric design (other literary devices, specific populations)
- Developing “smarter” stories (proactive, interactive, personalized)
Opportunities and future work

• Longitudinal deployments (months-long, large N, vs. conventional feedback)
• Narrative-centric design (other literary devices, specific populations)
• Developing “smarter” stories (proactive, interactive, personalized)
Thank you!

Questions? Thoughts? emurnane@stanford.edu

Designing Ambient Narrative-Based Interfaces to Reflect and Motivate Physical Activity

Elizabeth L. Murnane, Xin Jiang, Anna Kong, Michelle Park, Weili Shi, Connor Soohoo, Luke Vink, Iris Xia, Yu Xin, John Yang-Sammararo, Grace Young, Jenny Zhi, Paula Moya, James A. Landay