WASEDA University
Graduate School of Information, Production and Systems

3D Virtual Try-On System Using Personalized Avatars: Augmented Walking in the Real World

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IARIA

IPLAB

Profile

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Outline

- Introduction
- Related Work
- Goal & Proposal
- System Design
- Implementation
- Conclusion
- Limitation and Future Work

Introduction- Online Shopping

- With the continuous development of e-commerce, the number of consumers purchasing clothes online is increasing [1]
- **The lack of "direct try-on experience"**, which may lead to increase perceived risk of purchase due to the difficulty in judging the products' fit

Virtual Try-on technology appear

[1] Magnenat-Thalmann, Nadia, et al. "*3d web-based virtual try on of physically simulated clothes.*" *Computer-Aided Design and Applications* 8.2 (2011): 163-174

Introduction- Virtual Try-on

- Virtual Try-on (VTO) technology
  - Consumers can virtually try the garments on and gain a sense of garment details [2]
  - Assist consumers to accurately assess the fit and size in the online shopping environment [2,3]
  - Provide convenient and quick fitting for consumers [4]

[2] Blázquez, M. Fashion shopping in multichannel retail: The role of technology in enhancing the customer experience. International Journal of Electronic Commerce 2014, 18, 97–116. 750 7.
[3] Gao, Y.; Petersson Brooks, E.; Brooks, A.L. The Performance of Self in the Context of Shopping in a Virtual Dressing Room System. HCI in Business; Nah, F.F.H., Ed.; Springer International Publishing: Cham, 2014; 752 pp. 307–315.
[4] Beck, M.; Crié, D. I virtually try it. . . I want it! Virtual Fitting Room: A tool to increase on-line and off-line exploratory behavior, patronage and purchase intentions. Journal of Retailing and Consumer Services 2018, 740 40, 279–286.

Related Work (1/2)

- **2D overlay Virtual Try-on**: using AR, enables consumers to try a few augmented products on their selves in the display screen, also called Magic mirror [5]

- **Without using 3D information -> users can not view their garment from arbitrary viewpoints.**

[5] Javornik, A.; Rogers, Y.; Moutinho, A.M.; Freeman, R. Revealing the shopper experience of using a" magic 762 mirror" augmented reality make-up application. Conference on designing interactive systems. Association 763 for Computing Machinery (ACM), 2016, Vol. 2016, pp. 871–882.

Related Work (2/2)

- **3D Virtual Try-on:**
  - Clothes models and body models are 3D
  - Users can check the dressed model from different view

- **Predefined virtual body-> Not personalized**
- **Static**

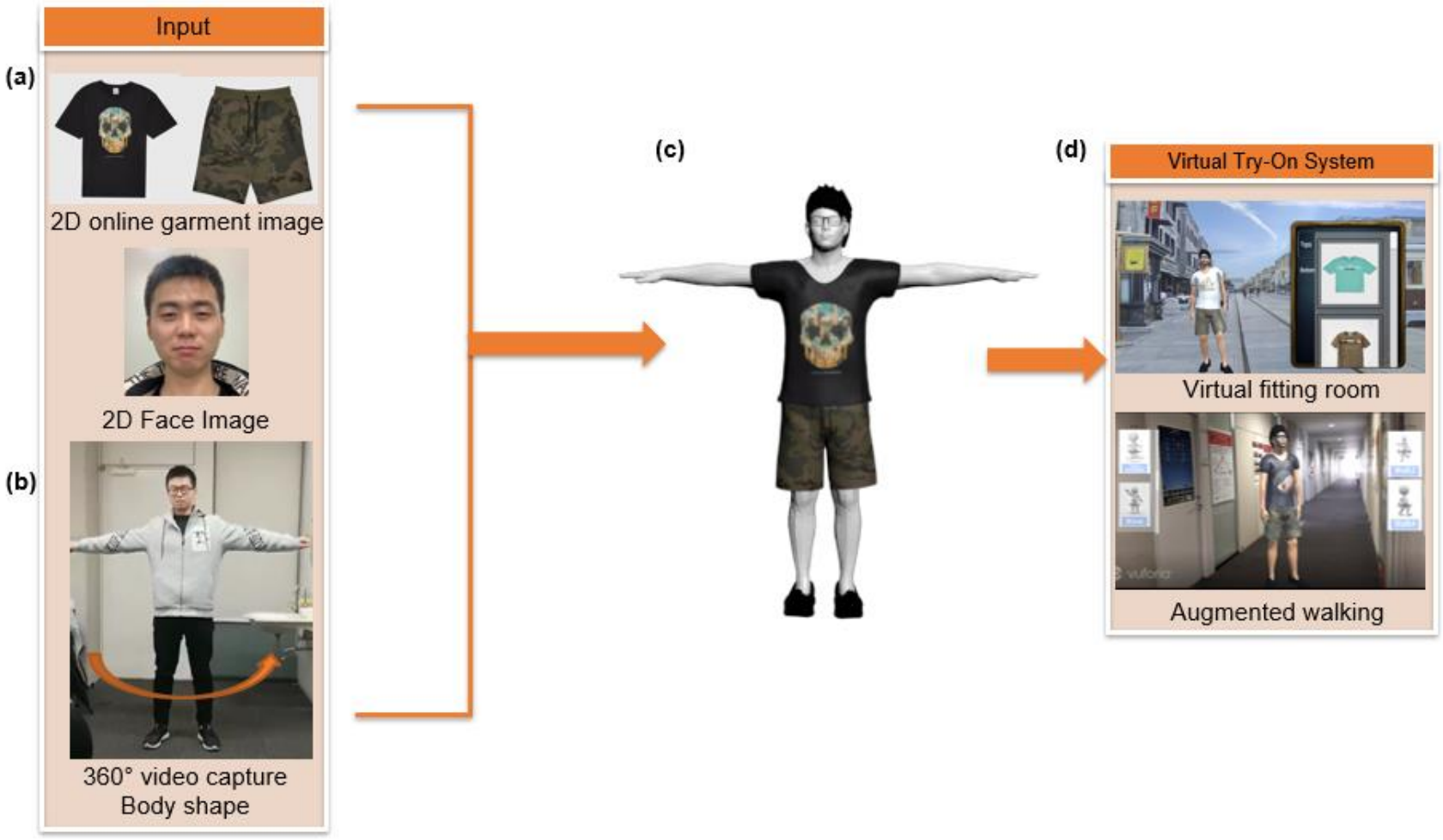
Goal & Proposal

3D Virtual Try-On System Using
Personalized Avatars:
Augmented Walking in the Real World

Propose a 3D virtual try-on system using personalized models, to enhance shopping experience for users

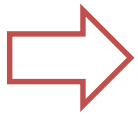
- **Personalized avatars**(body and face information)
- **3D garment visualization**(online garment images)
- **Augmenting the motion of a personalized user body in the real-world**(dynamic fitting…)

System Design – System overview



System Design – Human model personalization

- **Reduce the gap between physical fitting and online shopping**
  - An appropriate 3D human body representation corresponding to the real user's human body shape and face features



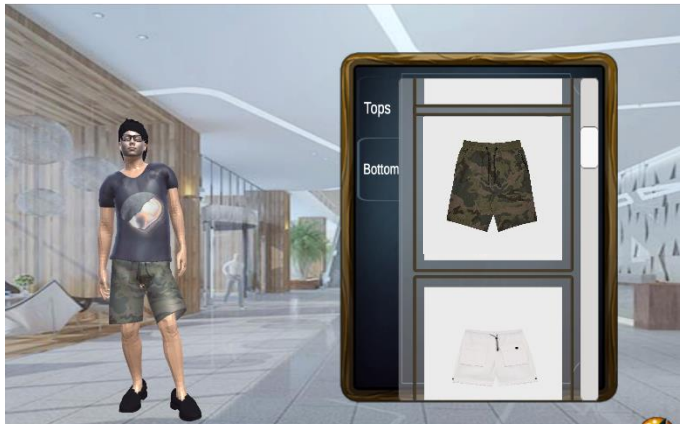
System Design – Garment model generation

◆ Provide a better online garment product visualization

- Our approach uses garment image information from existing shopping websites (i.e., H&M, Zara) to create a virtual garment

System Design – 3D Virtual Try-on

- **Combine VR (Virtual Reality) and AR (Augmented Reality) technology to simulate try-on experience**
  - **Virtual fitting:** users can view their personalized avatar fitting different clothes in several virtual scene
  - **Augmented walking**: users can view their avatar doing daily life activities in the real environment



Virtual fitting

Augmented walking

Demo Video

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Implementation — Hardware & Software

Hardware

- Mobile Devices:

  Google Pixel3

Software

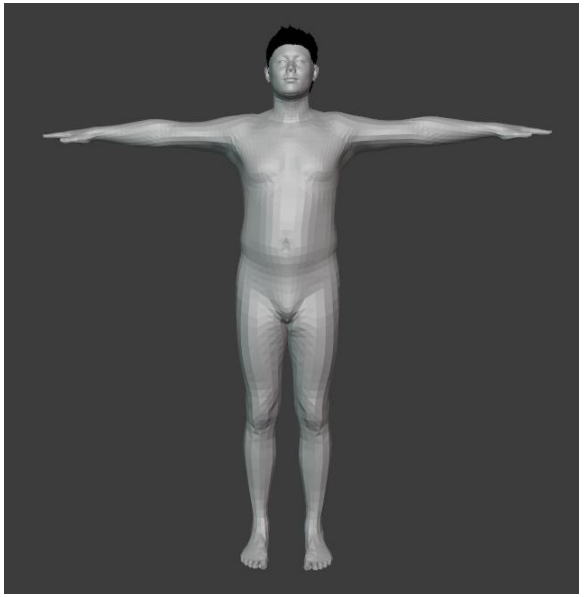
- Development Platform: Unity 2019
- 3D modeling: 3Ds MAX, Blender
- AR setting: Vuforia Augmented Reality SDK

Implementation– Human model personalization

- 3D human body representation corresponding to the real user's human body shape and face features

2D Face image

Deng's method [6]



360-degree video captured body shape

Thiemo Alldieck's work [7]

[6] Y. Deng et al., "Accurate 3D Face Reconstruction with Weakly-Supervised Learning: From Single Image to Image Set, " In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, 11pages, 2019. Retrieved from https://arxiv.org/abs/1903.08527

[7] T. Alldieck, M. Magnor, et al., "Video based reconstruction of 3d people models, " In 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, pp. 8387-8397, 2018. DOI:https://doi.org/10.1109/CVPR.2018.00875

Implementation – Garment model generation

3D Garment Model Templates

- Build several 3D templates of virtual garment models for the personalized human model using Cloth Weaver [8]

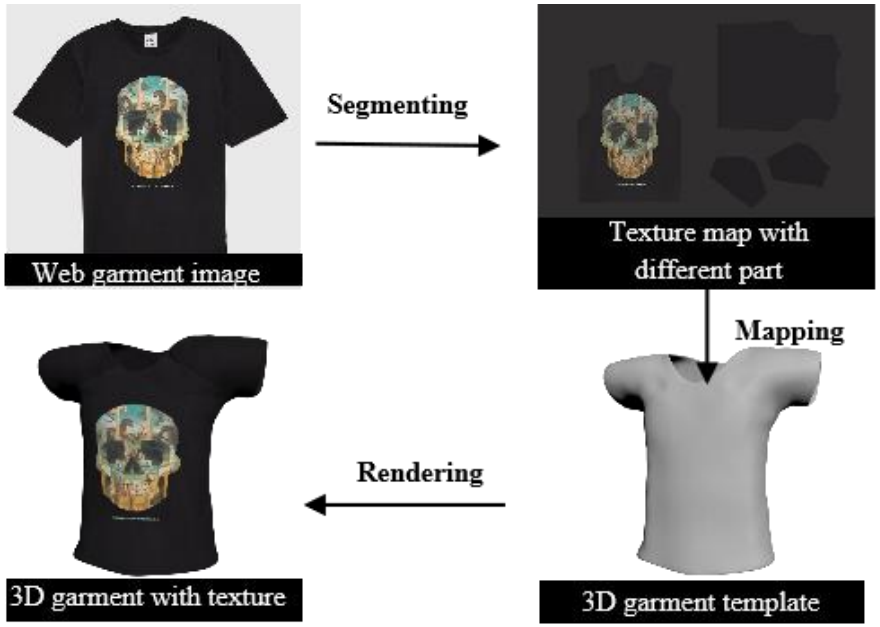
Several types of clothing templates for female bodies and male bodies

[8] Cloth-Weaver, https://clothweaver.com/

Implementation – Garment model generation

Texture Mapping

- Gather garment information from existing shopping websites (H&M, ZARA)
- Mapping these clothes images to generated 3D garment model templates



Implementation – 3D Virtual Try-on (1/2)

Virtual Reality(VR) -- Virtual fitting

- **Immersive and interactive shopping experience**
  - Several virtual fitting scene(on the street, in the office and at the supermarket)
  - Give outfit idea for various occasion or purpose

Fitting in different scenes

Implementation – 3D Virtual Try-on(2/2)

Augmented Reality(AR) -- Augmented walking

- **Dynamically interactive virtual try-on experience**
  - Animate dressed human body in 360 degrees
  - View virtual body doing natural activities in the real-life scene

Augmented motion in the real-life scene

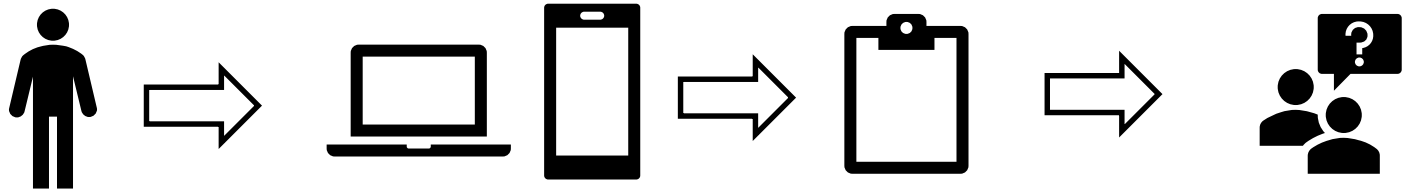
Evaluation

- **Participants:** A total of 10 college participants (7M, 3F).
- **Experiment Design:**

  (1) **Virtual try-on condition**: simulate the shopping experience with our 3D virtual try-on system

  (2) **Image only condition**: simulate typical online shopping experience with only images of garments online

- **Procedure:**



Personalize body model for each user | **Simulates the shopping experience with 2 conditions** | **7-point Likert scale questionnaire** | **Interview and open-ended feedback**

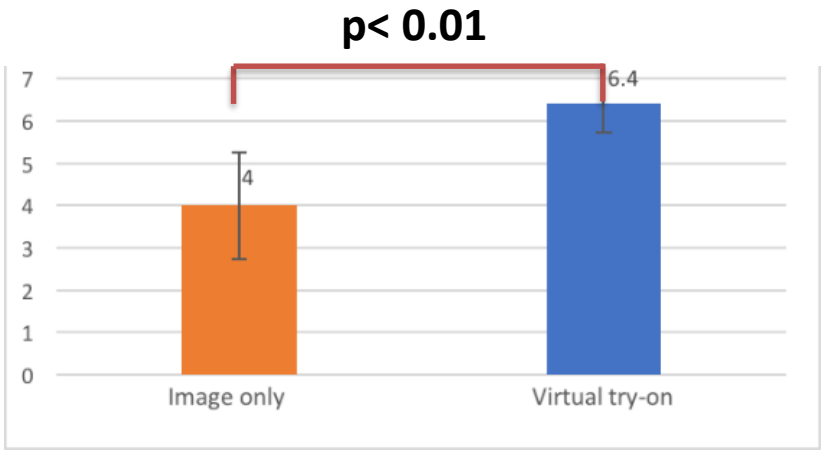
- **Measures:**

  Users' enjoyment, convenience, augmented walking and user behavior

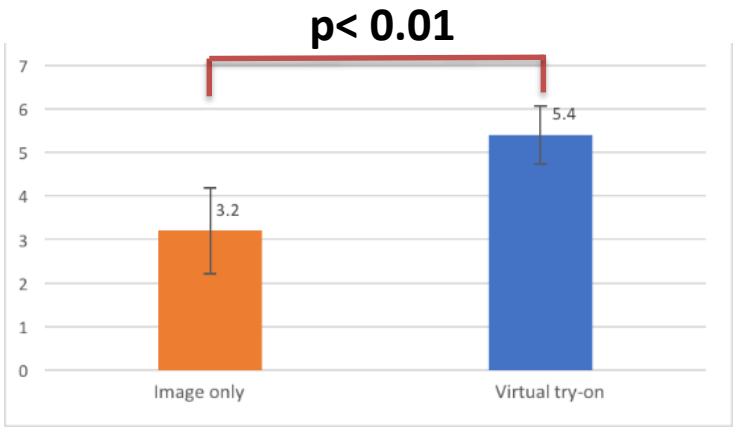
Result (1/3)

Users' enjoyment, convenience

- Participants rated the virtual try-on condition (p< 0.01) significantly higher than image only condition in terms of **users' enjoyment, convenience**



Enjoyment: Shopping experiences more enjoyable in virtual try-on condition

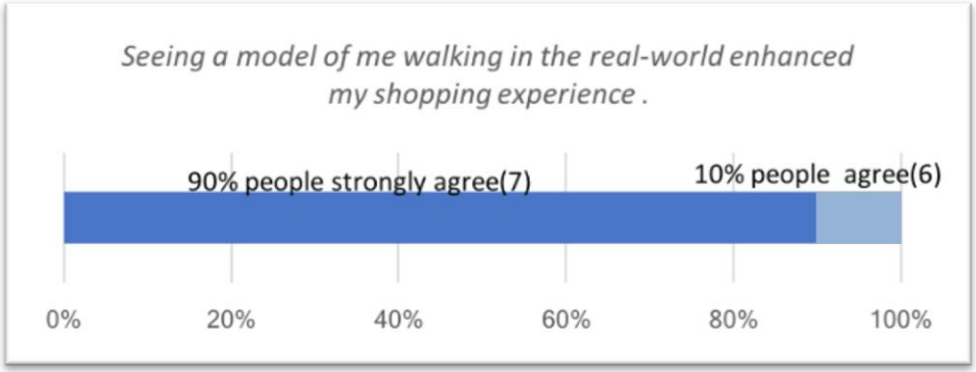


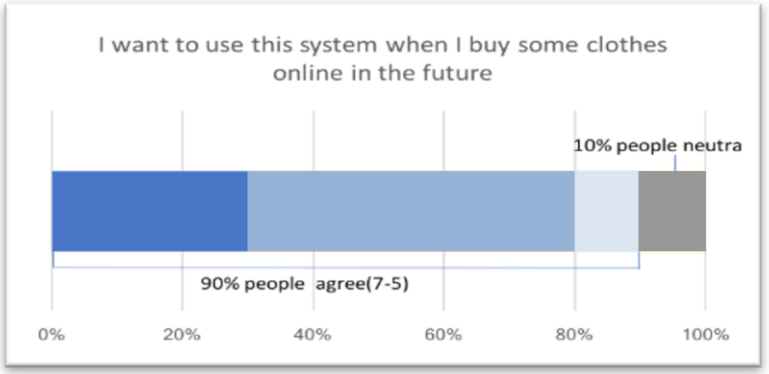
Convenience: virtual try-on condition gave users a better feel for how these clothes look like on their body

Result (2/3)

Augmented walking, user behavior

- Augmented walking can enhance shopping experience for users and provide a better 3D visualization for users
- All participants preferred the virtual try-on condition
- 9 out of 10 participants wanted to use our system in the future





Result (3/3)

Qualitative Results

Keyword	Conclusion
Garment model	• **Better understanding of the detail of clothes** • More realistic garment
Shopping experience	• **Narrow users' selections of clothes** • **Increase their purchase confidence.** • **Increase the enjoyment of shopping experience**
Augmented walking	• **Better judge of fitting** • More humanoid motion

Conclusion

Proposed a 3D VTO System using personalized avatars

- Virtual garment models generation based on online garment images
- Provide an interactive, dynamic virtual try-on experience for users using augmented walking

3D Virtual Try-on System is more enjoyable and more convenient than typical experience of using images only

- Enhance shopping experience, better judge of fitting, better understanding of the detail of clothes

Limitation and Future Work

Realistic garment

- Enhance clothing animations and **cloth simulation** methods
- Provide a more realistic virtual try-on effect

Humanoid motion

- **Motion capture** can also be used to better simulate user's walking motion
- Provide a more realistic and more interactive fitting experience

Thank you!