CSCI 599 - Introduction to Holodecks

Units: 4

Fall 2022 - Mondays and Wednesdays 2-3:50 pm

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Office Hours: Mon 12:30-1:30 pm, Wed 4-5:30 pm

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Course Description

A holodeck enables users to see virtual objects without glasses and to interact with them without wearing gloves or bodysuits. Holodecks may occupy physical volumes such as a tabletop cuboid or sphere, a telephone booth, a self-driving vehicle, a room, a concert hall, a stadium, or other well defined spaces. This course introduces students to Flying Light Specks (FLSs) as miniature drones with Red/Green/Blue (RGB) lights that fly as swarms to illuminate a virtual object. These illuminations provide true depth, enabling a user to perceive a scene more completely by analyzing its illumination from different angles. In addition, students are introduced to FLS-matter, a swarm of miniature drones to generate the tactile (simulating skin receptors only) and kinesthetic (muscle sense of pushing or lifting objects with mass) senses. These concepts enable immersive and interactive 3D displays depicted in science fiction shows, e.g., Star Trek's holodeck. A holodeck will revolutionize the future of human communication and perception, and how we interact with information and data.

Students will have the opportunity to conduct novel research and publish their work.

Learning Objectives

This course introduces students to:

- Virtual Reality, Augmented Reality, and Mixed Reality.
- Programmable matter such as Claytronics, BitDrones, Roboxels, and FLSs.
- Holographs.
- Encounter-type haptic devices.
- Centralized and decentralized algorithms for group formation.
- Collision prevention and detection techniques.
- Matlab and MathWorks for rapid prototyping and evaluation of algorithms.
- Physics engines such as Airsim and Gazebo to conduct simulation studies.

Prerequisite(s): Principles of Software Development (CSCI 201)

Recommended Preparation: Operating Systems (CSCI 356), AI (CSCI 360), Data Management (CSCI 485)

Course Notes: All lecture material will be posted on the USC blackboard system prior to lectures.

Technological Proficiency and Hardware/Software Required

Students should be proficient in design and implementation of concepts in different programming languages.

Required Readings and Supplementary Materials

Required readings and supplementary materials are based on recently published papers. USC students may use their provided ACM/IEEE/Springer digital library membership to download these papers for free.

Description and Assessment of Assignments

The course includes a class project. Students are encouraged to conduct their project on the numerous research topics related to the Flying Light Specks, FLSs.

Grading Breakdown

The class project is an important component of student grades. Projects may be done either individually or in teams.

Assessment Tool (assignments)	Points	% of Grade
Class Participation	100	10%
Exam 1 (10/12/2022)	100	30%
Project Description	100	30%
Final Project Report	100	30%
TOTAL		100%

Assignment Submission Policy

All project reports must be submitted using the USC blackboard system.

Grading Timeline

Exams will be graded promptly and returned in a week.
Project description and the final project report include an oral presentation.

Additional Policies

No late reports are accepted. All deadlines are final.
Class participation may include students presenting technical papers.
Students are rewarded with extra credit for conducting original research.

Course Schedule: A Weekly Breakdown

Week 1: FLS Displays & Claytronics

1. Shahram Ghandeharizadeh. 2021. Holodeck: Immersive 3D Displays Using Swarms of Flying Light Specks [Extended Abstract]. In ACM Multimedia Asia, Gold Coast, Australia, December 2021, Pages 1–7. Read extended arXiv version https://arxiv.org/abs/2111.03657

2. Ivan E. Sutherland. 1965. The Ultimate Display. In Proceedings of IFIP Congress. 506–508.

3. S.C. Goldstein, J.D. Campbell, and T.C. Mowry. 2005. Programmable matter. Computer 38, 6 (2005), 99–101. https://doi.org/10.1109/MC.2005.198

Dig Deeper (Optional Reading):

- Allen McDuffee. 2014. A Holodeck Videogame Designed to Train Soldiers, Wired. Jan, 2014. See https://www.wired.com/2014/01/holodeck/.
- Febretti, Alessandro et al. "CAVE2: a hybrid reality environment for immersive simulation and information analysis." *Electronic Imaging* (2013).

Week 2: FLS Illuminations & Group Construction (Matching Problem)

4. Shahram Ghandeharizadeh. 2022. Display of 3D Illuminations using Flying Light Specks. In ACM Multimedia, Lisbon, Portugal, October 2022.

5. Preis R. 1999. Linear Time 1/2-Approximation Algorithm for Maximum Weighted Matching in General Graphs. In STACS 99: Proceedings Symposium on Theoretical Aspects of Computer Science. 259–269.

Dig Deeper:

- Anna Chmielowiec, Spyros Voulgaris, and Maarten van Steen. 2014. Decentralized Group Formation. Journal of Internet Services and Applications 5, 1 (2014). https://doi.org/10.1186/s13174-014-0012-2
- Avis David. 1983. A Survey of Heuristics for the Weighted Matching Problem. Networks 13 (1983), 475–493.
- Jaap-Henk Hoepman. 2004. Simple Distributed Weighted Matchings. CoRRcs.DC/0410047 (2004). http://arxiv.org/abs/cs.DC/0410047.
- Edmonds Jack. 1965. Paths, Trees, and Flowers. Canada Journal of Math. 17 (1965), 449–467.
- Tutte W. 1947. The Factorization of Linear Graphs. Journal of London Mathematics Society 22 (1947), 107–11

Week 3: Encounter-Type Haptics (Guest Lecturer Heather Culbertson)

6. Victor Rodrigo Mercado, Maud Marchal, and Anatole Lecuyer. 2021. Haptics On-Demand: A Survey on Encountered-Type Haptic Displays. IEEE Transactions on Haptics 14, 3 (2021), 449–464.

7. Muhammad Abdullah, Minji Kim, Waseem Hassan, Yoshihiro Kuroda, and Seokhee Jeon. 2018. HapticDrone: An Encountered-type Kinesthetic Haptic Interface with Controllable Force Feedback: Example of Stiffness and Weight Rendering. In Proc. IEEE Haptics Symposium. IEEE, 334–339.

Dig Deeper:

- Lawrence H. Kim and Sean Follmer. 2019. SwarmHaptics: Haptic Display with Swarm Robots. In Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19). Association for Computing Machinery, New York, NY, USA, Paper 688, 1–13. DOI:https://doi.org/10.1145/3290605.3300918

Week 4: Roboxels & Bit-Drones

8. William A. McNeely. 1993. Robotic graphics: a new approach to force feedback for virtual reality. In Proceedings of IEEE Virtual Reality Annual International Symposium. 336–341. https://doi.org/10.1109/VRAIS.1993.380761

9. Antonio Gomes, Calvin Rubens, Sean Braley, and Roel Vertegaal. 2016. BitDrones: Towards Using 3D Nanocopter Displays as Interactive Self-Levitating Programmable Matter. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (*CHI '16*). Association for Computing Machinery, New York, NY, USA, 770–780. DOI:https://doi.org/10.1145/2858036.2858519 Presentation: https://www.youtube.com/watch?v=OBHmqsay7CA

10. Mario Lorenz, Sebastian Knopp, Philipp Klimant, Johannes Quellmalz, and Holger Schlegel. 2020. Concept for a Virtual Reality Robot Ground Simulator. In 2020 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct). 36–38. https://doi.org/10.1109/ISMAR-Adjunct51615.2020.00024

Dig Deeper:

- Ryo Suzuki, Clement Zheng, Yasuaki Kakehi, Tom Yeh, Ellen Yi-Luen Do, Mark D. Gross, and Daniel Leithinger. 2019. ShapeBots: Shape-changing Swarm Robots. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology (UIST '19). 493–505. https://doi.org/10.1145/3332165.3347911
- Sean Braley, Calvin Rubens, Timothy Merritt, and Roel Vertegaal. 2018. GridDrones: A Self-Levitating Physical Voxel Lattice for Interactive 3D Surface Deformations. In Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology (UIST '18). 87–98. https://doi.org/10.1145/3242587.3242658
- Calvin Rubens, Sean Braley, Julie Torpegaard, Nicklas Lind, Roel Vertegaal, and Timothy Merritt. 2020. Flying LEGO Bricks: Observations of Children Constructing and Playing with Programmable Matter. In Proceedings of the Fourteenth International Conference on

Tangible, Embedded, and Embodied Interaction (TEI '20). 193–205. https://doi.org/10.1145/3374920.3374948

Week 5: User Safety (Guest Lecturer, Luis Garcia)

11. S. Ghandeharizadeh and L. Garcia. Safety in the Emerging Holodeck Applications. In CHI 2022 Workshop on Novel Challenges of Safety, Security and Privacy in Extended Reality, April 25, 2022.

12. Colgate, Ed, Antonio Bicchi, Michael Aaron Peshkin, and James Edward Colgate. "Safety for physical human-robot interaction." In *Springer handbook of robotics*, pp. 1335-1348. Springer, 2008.

Dig Deeper:

- Matteo Rubagotti and Inara Tusseyeva and Sara Baltabayeva and Danna Summers and Anara Sandygulova. Perceived Safety in Physical Human–Robot Interaction—A Survey. Robotics and Autonomous Systems. Vol. 151, 2022, https://doi.org/10.1016/j.robot.2022.104047
- Sami Haddadin, Alin Albu-Schaffer, Gerd Hirzinger. Safety Evaluation of Physical Human-Robot Interaction via Crash-Testing. In Proc. Robotics: Science and System (RSS}, 2007.

Week 6: Quadcopters in Action

13. Jonas Auda, Nils Verheyen, Sven Mayer, and Stefan Schneegass. 2021. Flyables: Haptic Input Devices for Virtual Reality using Quadcopters. In Proc. ACM Symposium on Virtual Reality Software and Technology (VRST). 1–11.

14. Parastoo Abtahi, Benoit Landry, Jackie Yang, Marco Pavone, Sean Follmer, and James A Landay. 2019. Beyond the Force: Using Quadcopters to Appropriate Objects and the Environment for Haptics in Virtual Reality. In Proc. ACM CHI Conference on Human Factors in Computing Systems. 1–13.

Dig Deeper:

- Yousef Alghamdi, Arslan Munir, and H. La. 2021. Architecture, Classification,and Applications of Contemporary Unmanned Aerial Vehicles. IEEE Consumer Electronics Magazine (2021), 1–10.
- Soon-Jo Chung, A. Paranjape, P. Dames, S. Shen, and Vijay R. Kumar. 2018. A Survey on Aerial Swarm Robotics. IEEE Transactions on Robotics 34 (2018), 837–855.
- Hazim Shakhatreh, A. Sawalmeh, Ala Al-Fuqaha, Zuochao Dou, Eyad K. Almaita, Issa M. Khalil, Noor Shamsiah Othman, A. Khreishah, and M. Guizani. 2019. Unmanned Aerial Vehicles (UAVs): A Survey on Civil Applications and Key Research Challenges. IEEE Access 7 (2019), 48572–48634.

- Jonas Auda, Martin Weigel, Jessica R. Cauchard, and Stefan Schneegass. 2021. Understanding Drone Landing on the Human Body. In Proceedings of the 23rd International Conference on Mobile Human-Computer Interaction (MobileHCI '21). 1–13. https://doi.org/10.1145/3447526.3472031
- Viviane Herdel, Lee J. Yamin, and Jessica R. Cauchard. 2022. Above and Beyond: A Scoping Review of Domains and Applications for Human-Drone Interaction. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (CHI '22). 1–22. https://doi.org/10.1145/3491102.3501881

Week 7: Collision Prevention & Avoidance

15. Hang Sun, Juntong Qi, Chong Wu, and Mingming Wang. 2020. Path Planning for Dense Drone Formation Based on Modified Artificial Potential Fields. 39th Chinese Control Conference (CCC) (2020), 4658–4664

16. Ravinder Kumar Jyoti, Mohit Kumar Malhotra, and Debasish Ghose. 2021. Rogue Agent Identification and Collision Avoidance in Formation Flights using Potential Fields. In 2021 International Conference on Unmanned Aircraft Systems (ICUAS). 1080–1088. https://doi.org/10.1109/ICUAS51884.2021.9476866

17. Jiayi Sun, Jun Tang, and Songyang Lao. 2017. Collision Avoidance for Cooperative UAVs With Optimized Artificial Potential Field Algorithm. IEEE Access PP (08 2017), 18382–18390. https://doi.org/10.1109/ACCESS.2017.2746752

Dig Deeper:

- O. Khatib. 1985. Real-Time Obstacle Avoidance for Manipulators and Mobile Robots. In Proceedings. 1985 IEEE International Conference on Robotics and Automation, Vol. 2. 500–505. https://doi.org/10.1109/ROBOT.1985.1087247
- J. van den Berg, D. Wilkie, S. J. Guy, M. Niethammer and D. Manocha. LQG-obstacles: Feedback control with collision avoidance for mobile robots with motion and sensing uncertainty. In *2012 IEEE International Conference on Robotics and Automation*, 2012, pp. 346-353, doi: 10.1109/ICRA.2012.6224648.

Week 8: Review for Midterm and Midterm

Week 9: Matlab

Week 10: Holograms

18. Chenliang Chang, Kiseung Bang, Gordon Wetzstein, Byoungho Lee, and Liang Gao, "Toward the next-generation VR/AR optics: a review of holographic near-eye displays from a human-centric perspective," Optica **7**, 1563-1578 (2020).

19. Xiong, J., Hsiang, E., He, Z., Zhan, T., & Wu, S. (2021). Augmented reality and virtual reality displays: emerging technologies and future perspectives. *Light, Science & Applications, 10*.

Week 11: Physics Engines Airsim and Gozebo

20. N. Koenig and A. Howard. Design and Use Paradigms for Gazebo, An Open-Source Multi-Robot Simulator. In IEEE/RSJ International Conference on Intelligent Robots and Systems, pages 2149–2154, Sendai, Japan, Sep 2004

21. S. Shah, D. Dey, C. Lovett, and A. Kapoor. AirSim: High-Fidelity Visual and Physical Simulation for Autonomous Vehicles. In Field and Service Robotics, 2017.

Week 12: Localization/Positioning System

22. Adam Smith, Hari Balakrishnan, Michel Goraczko, Nissanka Priyantha,Tracking Moving Devices with the Cricket Location System, Proc. 2nd USENIX/ACM MOBISYS Conf., Boston, MA, June 2004.

Dig Deeper:

- Nissanka B. Priyantha, Anit Chakraborty, Hari Balakrishnan, **The Cricket Location-Support system**, Proc. 6th ACM MOBICOM, Boston, MA, August 2000.
- Hari Balakrishnan, Roshan Baliga, Dorothy Curtis, Michel Goraczko, Allen Miu, Nissanka B. Priyantha, Adam Smith, Ken Steele, Seth Teller, Kevin Wang, Lessons from Developing and Deploying the Cricket Indoor Location System, November 2003. (Preprint.)
- This paper describes the lessons learned from Cricket v1 and how Cricket v2's design builds on these lessons.
- Yanying Gu, Anthony C. C. Lo, and Ignas G. Niemegeers. 2009. A Survey of Indoor Positioning Systems for Wireless Personal Networks. IEEE Commun. Surv. Tutorials 11, 1 (2009), 13–32. https://doi.org/10.1109/SURV.2009.090103
- Souvik Sen, Dongho Kim, Stephane Laroche, Kyu-Han Kim, and Jeongkeun Lee. 2015. Bringing CUPID Indoor Positioning System to Practice. In *Proceedings of the 24th International Conference on World Wide Web* (*WWW '15*). International World Wide Web Conferences Steering Committee, Republic and Canton of Geneva, CHE, 938–948. DOI:https://doi.org/10.1145/2736277.2741686
- Jiang Xiao, Zimu Zhou, Youwen Yi, and Lionel M. Ni. 2016. A Survey on Wireless Indoor Localization from the Device Perspective. *ACM Comput. Surv.* 49, 2, Article 25 (June 2017), 31 pages. DOI:https://doi.org/10.1145/2933232
- *C. Watson. Permanent Magnet-Based Localization for Growing Robots in Medical Applications, Dissertation.*

Week 13: 3D Acoustics

23. Mehra, Ravish and Raghuvanshi, Nikunj and Antani, Lakulish and Chandak, Anish and Curtis, Sean and Manocha, Dinesh. 2013. Wave-Based Sound Propagation in Large Open Scenes Using an

Equivalent Source Formulation. ACM Trans. Graph. 32, 2, Article 19 (April 2013), 13 pages. https://doi.org/10.1145/2451236.2451245

24. Shiguang Liu and Dinesh Manocha. 2020. Sound Synthesis, Propagation, and Rendering: A Survey. CoRR abs/2011.05538 (2020). arXiv:2011.05538 https://arxiv.org/abs/2011.05538

Dig Deeper:

- Nikunj Raghuvanshi and John Snyder. 2018. Parametric Directional Coding for Precomputed Sound Propagation. ACM Trans. Graph. 37, 4, Article 108 (July 2018), 14 pages. https://doi.org/10.1145/3197517.3201339

Week 14: Noise Reduction

25. Miljković. Methods for attenuation of unmanned aerial vehicle noise. *2018. In the 41st International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO)*, 2018, pp. 0914-0919, doi: 10.23919/MIPRO.2018.8400169.

Dig Deeper:

- W. Herkes, R. Olsen, and S. Uellenberg. 2012. The Quiet Technology Demonstrator Program: Flight Validation of Airplane Nois Reduction Concepts. In 12th AIAA/CEAS Aeroacoustics Conference (27th AIAA Aeroacoustics Conference). https://doi.org/10.2514/6.2006-2720 arXiv:https://arc.aiaa.org/doi/pdf/10.2514/6.2006-2720

Week 15: Project Presentations

	Topics/Daily Activities	**Readings/Preparation**	**Deliverables**
Week 1 8/22&24	FLS displays, Claytronics & Catoms,	Ghandeharizadeh FLS displays, Sutherland Ultimate Display, Goldstein Catoms	3D Illuminations Matter for the Holodeck
Week 2 8/29&31	Group Construction, Matching Problem	Preis centralized algorithm, Chmielowiec decentralized algorithm	Centralized and decentralized algorithms to form groups
Week 3 Labor day & 9/7	Encounter-Type Haptics (Guest Lecturer Heather Culbertson)	Rodrigo Haptics-On-Demand, Abdullah HapticDrone	Encounter-Type Haptics
Week 4 9/12&14	Roboxels, Bit-Drones, Fast 3D printing	McNeely Roboxels, Gomez Bit-Drones	Matter for the Holodeck Walking in a Holodeck

Week 5 9/19&21	User Safety (Guest Lecturer Luis Garcia)	Ghandeharizadeh & Garcia Safety in Holodeck App	User Safety
Week 6 9/26&28	**Project Reports due 9/28** & Quadcopters	Auda Flyables, Abtahi Beyond the Force,	**Class Projects** Quadcopters in different applications
Week 7 10/3&5	Collision Detection & Avoidance	Sun APF Path Planning, Jyoti Rogue Agent, Sun APF Collision Avoidance	Artificial Potential Field (APF) Algorithm
Week 8 10/10&12	**Review for Exam 1** **Exam 1 is on 10/12**		
Week 9 10/17&19	Introduction to Matlab & Mathworks	Motion illumination using FLS	Abstractions & modeling
Week 10 10/24&26	Holograms	Chang Review, Xiang Future	Holograms, AR and MR
Week 11 10/31&11/2	Physics Engines	Airsim & Gozebo	Simulation studies
Week 12 11/7&9	Indoor Positioning System	Smith Cricket	Device tracking techniques
Week 13 11/14&16	3D Acoustics	Mehra Wave-Based Sound Propagation	Sound in games
Week 14 11/21&23	Noise Reduction	Herkes Quiet Technology	Suppress drone noise
Week 15 11/28&30	**Project Presentations**		
FINAL	**Final Project Reports**		Refer to the final exam schedule in the USC *Schedule of Classes* at classes.usc.edu.

Time Permitting

Self-Assembly

26. Saldaña, David & Gabrich, Bruno & Li, Guanrui & Yim, Mark & Kumar, Vijay. (2018). ModQuad: The Flying Modular Structure that Self-Assembles in Midair. In 2018 IEEE International Conference on Robotics and Automation (ICRA). IEEE Press, 691–698. 10.1109/ICRA.2018.8461014.

27. D. Saldaña, P. M. Gupta and V. Kumar (2019). Design and Control of Aerial Modules for Inflight Self-Disassembly. In *IEEE Robotics and Automation Letters*, vol. 4, no. 4, pp. 3410-3417, Oct. 2019, doi: 10.1109/LRA.2019.2926680.

Immersive Human Computer Interaction System

28. Serrano, R., Morillo, P., Casas, S., & Cruz-Neira, C. (2022). An empirical evaluation of two natural hand interaction systems in augmented reality. *Multimedia Tools and Applications*.

Dig Deeper:

- Lu, G., Shark, L., Hall, G., & Zeshan, U. (2011). Immersive manipulation of virtual objects through glove-based hand gesture interaction. *Virtual Reality, 16*, 243-252.
- Tijana Vuletic, Alex Duffy, Laura Hay, Chris McTeague, Gerard Campbell, Madeleine Grealy, Systematic literature review of hand gestures used in human computer interaction interfaces, International Journal of Human-Computer Studies, Volume 129, 2019, Pages 74-94, ISSN 1071-5819, https://doi.org/10.1016/j.ijhcs.2019.03.011.

Data Physicalization

29. S. Sandra Bae, Clement Zheng, Mary Etta West, Ellen Yi-Luen Do, Samuel Huron, and Danielle Albers Szafir. 2022. Making Data Tangible: A Cross-disciplinary Design Space for Data Physicalization. In Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems (CHI '22). Article 81, 1–18. https://doi.org/10.1145/3491102.3501939

30. Yvonne Jansen, Pierre Dragicevic, Petra Isenberg, Jason Alexander, Abhijit Karnik, Johan Kildal, Sriram Subramanian, and Kasper Hornbæk. 2015. Opportunities and Challenges for Data Physicalization. In Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15). 3227–3236. https://doi.org/10.1145/2702123.2702180

Swarms

31. Craig W. Reynolds. 1987. Flocks, herds and schools: A distributed behavioral model. In Proceedings of the 14th annual conference on Computer graphics and interactive techniques (SIGGRAPH '87). ACM 25–34. https://doi.org/10.1145/37401.37406

32. S. -J. Chung, A. A. Paranjape, P. Dames, S. Shen and V. Kumar, "A Survey on Aerial Swarm Robotics," in *IEEE Transactions on Robotics*, vol. 34, no. 4, pp. 837-855, Aug. 2018, doi: 10.1109/TRO.2018.2857475.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on Research and Scholarship Misconduct.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call

studenthealth.usc.edu/counseling
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call
suicidepreventionlifeline.org
Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL), press "0" after hours – 24/7 on call
studenthealth.usc.edu/sexual-assault
Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
eeotix.usc.edu
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
usc-advocate.symplicity.com/care_report
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
osas.usc.edu
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.
USC Campus Support and Intervention - (213) 821-4710
campussupport.usc.edu
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
diversity.usc.edu
Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call
dps.usc.edu, emergency.usc.edu
Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call
dps.usc.edu
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)

ombuds.usc.edu
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-3340 or otfp@med.usc.edu
chan.usc.edu/otfp
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.