Virtual, Augmented and Extended Reality at UCLA

Prepared by the Virtual Reality Institute Task Force

February 8, 2019

Opportunity

In November 2017, a Virtual Reality Institute Task Force was formed by the Executive Vice Chancellor and Provost, Scott Waugh, and charged with helping to explore the idea of a multi-disciplinary Virtual Reality Institute at UCLA. This task force was chaired by Dean Jennifer Mnookin, and included Professor Rebecca Allen, Associate Dean Jeffrey Burke, Professor Devon Carbado, Associate Clinical Professor Eric Esrailian, Program Director Scott Hutchinson[1], Professor Mayank Mehta, and Professor Demetri Terzopoulos.

As the charge to this task force indicated, virtual and augmented reality (VR and AR) will have a wide-ranging impact on all aspects of society. These technologies are also quite likely to have far-reaching implications for the University of the future. VR, AR, and other emerging extended reality (XR) technologies are creating modes of human experience that change the way we perceive reality. These technologies will allow us to solve problems that would otherwise be unsolvable and tell stories we otherwise could not tell; and they will also serve as tools for understanding and explaining concepts across a wide range of disciplines. It is difficult to overstate the vast implications of a full immersion system, one able to trick the brain so that the user cannot distinguish between reality and the technology. Long a mainstay of science fiction (from Star Trek's holodeck to films like Tron and Ready Player One, to name a few of many), the real-world potential and impact of immersive technologies are growing rapidly. As just one concrete example of this work in action, one member of this committee has already been able to shut off portions of the brain using VR (in mice) to study the brain in ways that were previously inconceivable. As another, down the street in Century City, DreamScape Immersive has now opened its first VR cinema-like experiences to the public.

The possibilities for XR[2] technology are substantial, exciting, and rapidly unfolding. As the nation's top public research university, we believe UCLA is well-positioned to play a leading role in the development, application, and study of these technologies. Today, faculty and other researchers at UCLA are already actively developing and applying XR through transformative research and creative work. True to our broad strengths as a top research university, work with these innovative technologies extends across a variety of departments on both north and south campus. At the same time, a number of committee members and colleagues also believe that we are at a critical moment where if we do not create some broad campus focus and investment in this area we will lose an important opportunity to be a leader in this space. The task force has grappled with the challenge of balancing this urgency with other goals and the realities of funding limitations. These challenges, however, do not detract from the exciting possibilities presented by a campus-wide XR initiative.

We do not wish to engage in breathless rhetoric about XR and its potential, but we do believe that it is highly unusual to have a technology/experience platform with so much potential to radically alter how we consume and receive information, potentially across all academic areas. The broad impact and interdisciplinary nature of XR research creates an unusually powerful opportunity to engage many

[1] Please note that Associate Dean George Ingersoll also participated in the task force process until his departure from UCLA this past fall. In addition, Scott Hutchinson joined the taskforce mid-way to replace Tim Jones, who left the university.

[2] For brevity, we use the term XR in the rest of the document to denote VR, AR, MR, and XR technologies as a whole.

disciplines and units across the UCLA campus in an integrated and collaborative way—from the disciplines represented by members of this task force (the arts, including performance, design and media arts; medicine, law, communications, biological physics, and computer science), to psychology, architecture, anthropology, engineering, public policy, and numerous other academic departments as well as the health system, extension, and public arts units. The possibilities for initiatives, engagement, and important research that cross 'north' and 'south' campus, and the potential to reach students and faculty across the campus community are part of what this task force finds so exciting about the prospect of a campus-wide XR initiative. We believe that XR technology presents a rare opportunity for campus to invest in a way that will create deep, ongoing interaction across the campus. The promise of this long-term potential is one reason to aim high in this space, but we also recognize that to build something large we may need to start out with smaller engagements and work to scale.

Over the past year, the task force has convened six times.[3] One initial area of focus for the task force was to develop a broader understanding of the range of current research, scholarly projects and creative activity taking place on campus that implicate or connect to VR and AR technologies. To pursue that information, in the spring of 2018, we conducted a campus-wide survey of faculty, which was distributed via deans and departments and asked for responses from any faculty member whose work connects to virtual or augmented reality. This survey produced 71 responses from faculty across campus, a number of whom expressed a desire to be engaged in future campus efforts. The results of this survey are attached as Appendix A. In addition to developing and analyzing this survey, we wished to have some canvassing of what was taking place elsewhere. We are grateful to the UCLA Law Library who assisted with undertaking a review of work occurring at peer institutions. This survey of major university virtual/augmented reality programs, centers, institutes, labs and projects is attached as Appendix B. Finally, to educate the committee about some of the research and perspectives already in the works here at UCLA, and to give us additional perspective and food for thought, we also held a mini-symposium this past fall, during which we heard from faculty (including several committee members) whose work connects with XR technology, and engaged in a discussion with these faculty about possible future directions for campus. In recognition of the importance of bringing industry into this conversation, we also invited a member of the team at Google for VR/AR university partnerships to participate in the symposium. The agenda for this mini-symposium is attached as Appendix C.

Key Questions

With this data in hand, the task force quickly identified several key questions related to formulating a recommendation. We began by thinking about the frame for our work as a task force and asking ourselves to imagine the scale of UCLA's ambition in the field of XR; the range of possible forms of engagement with XR technology; and the options for UCLA to stand out in the space. A few of the key questions we asked include:

1. How can UCLA develop the unique identity and focus necessary to be a leader at the cutting edge of this fast-moving global field with many players?
2. How can UCLA best leverage its strengths, while "raising all ships" and providing engagement opportunities for as much of the campus community as possible?
3. How do the many opportunities for using XR for learning, as well as the many informal opportunities for students and faculty to explore XR on their own, intersect with research that fundamentally advances XR itself as well as research in other fields?

[3] The task force has received significant staff support and assistance from Tracey Parr, Associate Dean for Academic Programs and Strategic Planning, UCLA Law; Lauren Kim, Dean's Chief of Staff, UCLA Law; Kevin Gerson, UCLA Law Librarian; and Patricia Deacon, Assistant to the Vice Chancellor, UCLA Health Sciences. We are very grateful to all of them for their assistance, as well as to the participants in our mini-symposium for sharing their thoughts and ideas.

4. How do we address the scale of this opportunity appropriately for the top-ranked public university in the US without pricing ourselves out of what can be reasonably achieved?

We concluded that in order for UCLA to become a global leader in XR, substantial focus and investment will be necessary, requiring some investment of institutional resources as well as significant additional funding from philanthropy and/or grants. We also believe that to develop leadership in this space, there needs to be a focus on creating the structures to support and encourage high quality research and creative work. At the same time, the immersive potential of XR and its potentially widespread possibilities mean that there is also likely to be significant value in 'seeding' exposure to XR among a broad set of students and faculty and providing engagement opportunities for as much of the campus community as possible, not only for those for whom it is a research focus. With this in mind, we have developed an incremental approach to engage in cutting-edge research, design and development work on the one hand, and to increase campus-wide knowledge of, and exposure to, XR on the other. These are both valuable efforts in their own right, and likely are synergistic with each other, at least to some degree. We also recognize that interim steps in each can build a case for more significant investment to establish UCLA's place as a leader in this field – but while both are important, we would deem the scholarly/research side to be the more salient focus if our goal is to be a significant intellectual leader in this space.

After discussion as a task force, and after hearing from participants in our 'mini-symposium' of several of UCLA's researchers with an XR focus, we concluded that going forward in any serious way with a UCLA campus-wide XR initiative will require substantial resources. However, we also thought it responsible and prudent to assess what UCLA would be able to accomplish without the investment of much, if any, additional funding. After all, UCLA already has a number of field-specific areas of strength in the development and application of XR technologies, from medicine to the arts. We could continue down a decentralized path without a major campus investment or primary focus. What could we do without any significant infusion of resources? One option, aimed at making a modest attempt to incubate and spur further developments, would be for the campus to facilitate new networking opportunities among faculty for sharing information about existing projects and resources across departments. This could potentially occur under the existing auspices of the Vice Chancellor for Research, and it could be coupled, if possible, with a small XR-focused seed grant program. The one major advantage of this path is that it would cost very little. It would also be entirely institutionally ecumenical, not forcing potentially hard choices about path and direction raised in the questions above.

However, we believe that this approach has several very important limitations as well. One significant disadvantage is that it would not provide any meaningful campus-level leadership specifically in this important area, nor would collaborations across disciplines be incentivized or otherwise pushed forward. It also would mean that we would not, at the institutional level, be poised to build relationships with relevant industries' activities (though of course individual research teams might be able to do so). Our institutional profile in the field would therefore likely be limited. While individual researchers and groups of researchers might be able to pursue grants and philanthropy, this model does not seem optimal for making XR a signature area of interest or a broader campus strength. Moreover, when we canvassed other schools' existing approaches to XR issues, we found that there are already quite a number who seem to have cross-disciplinary institutes, centers, and other sizeable engagements and foci in this area. (As mentioned above, we did not do a full-scale analysis of what is taking place at other campuses. But for a set of examples of what is happening at a variety of other universities, based on their website descriptions, see Appendix B.)

We do not recommend this minimalist approach. We nonetheless wished to describe and name it, because it is the only possibility that does not require meaningful institutional (and philanthropic) investment. We therefore do want to point out that there could be some degree of benefits from even a minor degree of coordination efforts and institutional focus, though we also do not wish to overstate the potential of such a model.

Our Proposed Approach: Thoughtful Steps Towards a Major Institute

We believe that UCLA can capitalize on existing areas of strength and create the space for ongoing innovation, cross-departmental collaboration, and student-focused training programs. We recommend a phased approach that aims high while starting with significant but achievable actions executed quickly to capture interest and leverage the momentum of ongoing work on campus. The proposed phases are as follows:

Phase 1. Dedicate meaningful funding, ideally beginning in FY19-20, to support and spur excellence and innovation in areas of strength and strategic value; continue this program for at least three years.

Phase 2. In parallel, develop a plan for a major UCLA XR Institute, building on campus strengths and requiring external investment. Aim to raise funds and launch an Institute by summer 2021.

Parallel Initiatives: Allocate additional funding no later than FY20-21 to:

a. Create opportunities for both formal and informal learning about XR through expanding existing course, lab, and instructional design structures, to provide a foundation within campus life that supports and engages the work of the Institute when it is funded.
b. Support and potentially expand the faculty in areas critical to foundational XR innovations, in areas of focus consistent with the plan.

Below, we outline each of these phases in more detail, but first describe our recommendation for how to focus the campus effort.

Focus and Identity

UCLA is already working in several areas at the cutting edge of research and creative engagement with XR technology. For example, UCLA's Center for Advanced Surgical & Interventional Technology (CASIT) houses operating rooms with state-of-the-art surgical technology for patient care and interactive models using adaptive technology for surgical training programs. CASIT is also a field leader in the use of XR technologies to model injuries and develop plans for surgical treatment, for example in the field of combat. Another example across campus is the work at the UCLA School of Theater, Film & Television on immersive technology, interactive environments, and social impact entertainment, as well as many years of leading work in XR by faculty in Design, Media Arts and Architecture. A number of individual faculty are also making significant contributions relating to XR in a variety of fields, whether through research advancements on the implications of XR technology on cognition and brain processing; the design of new forms of XR technology for research and entertainment purposes; the development of pioneering laboratory spaces for use in research on everything from cognitive neuroscience to psychology, and the potential effects of XR on our legal system and our modes of collective engagement. Others are pursuing the possible uses of XR for teaching and pedagogy.

One of UCLA's strengths is our enormous breadth. We therefore recommend a cross-disciplinary XR leadership team charged with engaging faculty and units across campus to promote institution-wide growth in XR. In our assessment, the most significant areas of current demonstrated strength in XR are in the arts and the health sciences; we thus recommend that faculty in these departments be identified to lead the XR effort at UCLA, with the remit and support to engage broadly with the other areas of interest, expertise, and activity on campus. There are also faculty well poised to think seriously about the cognitive, legal, regulatory, and policy implications of XR and we encourage engagement with these faculty as well. Finally, given the current plans for faculty growth in the Samueli School of Engineering, we also anticipate and hope that there will be faculty expansion in areas within the School with strong connections to XR, such as human-computer interaction and graphics. A greater degree of XR focus within Samueli would, in our view, be valuable and welcome additions to the leadership of any XR initiative.

We recognize that a practical challenge for moving forward with an XR initiative is that the two areas on campus with the most strength and interest, the arts and health sciences, are also the most different in size and otherwise available resources. While the health sciences may offer increased possibilities for attracting significant external investment, the relative impact of new research or philanthropic dollars into the arts is substantially higher, given the relative lack of government investment in these arenas. For this reason, the task force also recommends that at outset of the XR initiative, thoughtful attention be given to the creation of an institutional structure that supports both north and south campus research and engagement.

We believe it is too early to recommend a highly specific focus for the Institute within the broad array of possibilities. However, we wish to reiterate that we think that XR offers especially exciting opportunities to cross north and south campus in collaborative ways. If we can capitalize on the intersection and preeminent position of UCLA's schools of health sciences, engineering, and arts disciplines (including TFT), and our location in Los Angeles, we could be strongly positioned to have one of the world's leading XR Institutes. We thus think there is a significant case to be made that the intersection of arts/storytelling, technology, and healthcare should be a meaningful focus of the UCLA Institute, and industry partners in each of these areas can also ensure that UCLA has local stakeholder groups that have a vested interest in its success.

For just one concrete possibility that draws on such hybrid engagement, consider the possibility that UCLA and a fledgling Institute organize around the research and capacity building needed to create cutting-edge, public XR experiences at scale for the 2028 Summer Olympics that tell the diverse stories of historical and contemporary Los Angeles, and their intersection with the sports and cultures of the our Olympic visitors, in uniquely compelling ways that will only be possible through technologies and techniques created at UCLA. Such a focus could break new ground for the campus in collaborative work across storytelling, history and the social sciences, sports medicine, technology and other fields, and would create the potential to share that work—and in the process UCLA's principles, vision, and identity—with the world.

To be clear: we do not mean to put that idea forward as the appropriate or primary focus for a fledgling Institute, but rather as an example of the kind of cross-campus collaborative framework that might be able to generate something quite distinctive in this space, consistent with our many cross-campus strengths and our public mission. We recognize that there are many exciting department/unit/school-specific uses for XR as well – CASIT is one strong example thereof. But we would hope that at least a portion of an XR Institute would be devoted to fostering cross-disciplinary engagement in a deep and significant way.

Phases of Development

XR technology requires state-of-the-art facilities for innovation, ongoing funding for new technology, as well as centralized resources devoted to encouraging the exchange of ideas and applications across the wide range of subject matter areas that will be impacted by this technology. Of course, each of these steps forward involves the investment of faculty and staff time, potential physical (or virtual) spaces, and an infusion of resources. With this in mind, we have developed a phased approach for moving forward. The initial phase will build on UCLA's current departmental and campus-wide engagements with XR technology, spur groundbreaking new work, and develop UCLA's internal leadership capacity and reputation in the field, while at the same time encouraging widespread engagement with XR technology across campus.

Phase 1. Promote Strategic investment in XR projects

We recommend the dedication of meaningful funding soon – perhaps as soon as FY19-20 – to support and spur excellence and innovation in areas of strength and strategic value; continue this program for at least three years, by which point, the program would aspire to be wholly philanthropically supported.

The first phase would involve launching a meaningful XR initiative in FY19-20, which would extend for the next three to five years, focused on capacity building through a seed-grant funding initiative. This funding initiative would operate on two levels:

First, several seed grants would support faculty researchers already working in XR by providing competitive internal awards to explore innovative work and/or to scale up impressive existing research as continued proof-of-concept for major donors. Based on the scale of funding that has had real impact on current faculty work and the potential to move the needle in this space, we propose three to five $250k/2 year awards allocated annually. We would welcome the notion that at least half of the awardees be multi-disciplinary and for a balance of initiatives across all campus disciplines.

Second, we propose that this new initiative would support a number of significantly more modest grants in the range of $10K to $20K per year, which would encourage faculty new to the area to explore XR technology within their field or engage in cross-departmental collaborations, including pedagogical collaboration. Conceivably some small seed grants could also be available to doctoral candidates, or for XR-related teaching initiatives.

This dual initial funding structure, at two quite distinct levels, would accomplish several concurrent goals. The larger grants would serve to spur innovation to put UCLA's work in XR on the map and to pave the way for UCLA to establish a foothold as a leader in the field. It would also provide an opportunity to give meaningful funding to projects that would, themselves, help spur further philanthropic and grant investment to expand our leadership and our XR footprint further. At the same time, we recognize that there are many faculty across campus potentially interested in exploring XR technology, or bringing it into the classroom, and we wish to encourage this exploration. The availability of modest funding for these efforts will lead to a wider engagement with XR, which will also be crucial groundwork for larger initiatives and leadership into the future.

Depending upon the degree of allocated funding from institutional resources and/or philanthropy, this seed grant program could be administered by a new full-time administrative director for the Institute; or, potentially it could be administered by an existing institutional structure and/or a steering committee of faculty and administrators. If the campus devotes resources to hiring a full-time administrative director to oversee the seed-grant initiative, this director could also engage with internal and external stakeholders to share information and resources and provide the necessary collaboration infrastructure for on-campus research and clinical/production work. The director could also lead an annual conference in XR to build connections and capacity in this space, and to help develop proposals for larger-scale industry, philanthropic, or government funding.

We envision the funding requirements for launching the seed-grant initiative would be $1-2M/year for 5 years, depending on award number, amounts and staffing allocation.

Phase 2. UCLA XR Institute

In parallel, we recommend that UCLA develop a plan for a major UCLA XR Institute, designed to build on campus strengths and requiring significant external investment.

UCLA's current research and teaching, as well as its Southern California location, positions it as a potential leader in the development and application of XR technology. However, becoming a global leader will require a significant philanthropic commitment, and with this in mind, we think the seed-grant funding initiative above could both be successful on its own terms and also lay the groundwork and vision necessary to draw significant donor investment.

Ultimately, in order to position the campus to lead, we envision creating a campus-wide UCLA XR Institute. The UCLA XR Institute would focus on the innovative development of applications of extended reality in arts, entertainment, science, and medicine and other areas; house state-of-the-art core technological facilities and support discipline-specific labs; and provide leadership for cross-departmental educational and pedagogical programs.

A major XR Institute would have the potential to seed new research in XR of the sort that can only be done at a major research university; house state of the art technology; incentivize and support collaboration across disciplines; scale up successful projects; and translate results to industries and communities outside the university. We envision a complete spectrum of engagement from exploratory through translational research. The Institute could provide faculty with the means to explore promising high-risk, high-reward directions faster than a total reliance on traditional grant funding would allow. It would also provide a home for long-term research that relies on multidisciplinary collaboration, core facilities, and the building of institutional knowledge. For work ready to "leave the lab," the Institute could enhance UCLA's tech transfer capability for XR and leverage the university's capacity for public service—e.g., through clinical work and professional artistic production; we suggest that this is an important long-term strength. The UCLA XR Institute would be housed in a state-of-the-art interdepartmental facility to support the efforts of the Institute and affiliated faculty, as well as supporting advanced teaching and learning projects.

In addition, the XR Institute would support the translation of UCLA work and research in this area to an audience beyond campus, and might provide productive pathways for industry partnerships. There might be possibilities for industry 'members' with a model akin to MIT's Media Lab. We could also imagine creating an XR-specific spinoff / incubator; expanding existing professional/clinical practice (for example in the UCLA Health System); and developing student internships or other means of providing opportunities for talent transfer. We might also engage with the community through projects with pre-college communities, perhaps with the UCLA Lab School, UCLA Community Schools, or the Geffen Academy.

This would require significant resources. A fully realized XR Institute, would likely require funding at the level of at least $25M startup plus $50M - $100M endowment to support new faculty FTEs, staffing, and core research funding, along with the creation and allocation of dedicated space(s) for research, production/clinical work, and support. Absent quite substantial philanthropic commitment, we recognize that a fully realized UCLA XR Institute is unlikely to be feasible in the short-term. Our hope is that this phased approach could permit forward movement that would also create the base out of which a case for a substantial and visionary Institute could develop. Phase One permits UCLA to encourage innovative research and scholarship using emerging technologies; engage students and support student-focused training; and create spaces for cross-departmental engagement, while also building up the institutional programming and capacity needed to fundraise for and launch a full Institute. In essence, we believe that our chances of achieving an XR institute at this substantial scale can be increased significantly by a thoughtful approach to Phase One and decision-making around the implementation of Phase One that recognizes a major XR Institute as a serious campus-wide aspiration.

Parallel Initiative 1: Integration with Teaching and Learning

Allocate additional funding no later than FY20-21 to create opportunities for both formal and informal learning about XR through existing course, lab, and instructional design structures, to provide a foundation within campus life that supports and engages the work of the Institute when it is funded.

The initiatives described above have been primarily focused on building the capacity for UCLA to lead in XR research, scholarship, and other creative work. However, the task force believes that teaching and curriculum in the domain of XR also matter quite significantly to creating an innovative campus culture around these areas. There are, of course, synergies between initiatives focused on research and those focused on teaching and curricular development, but one does not necessarily follow from the other without

additional focus and support. Thus, we recommend a third thread of campus effort to support XR as part of the university's educational mission and to encourage broad student and faculty engagement with XR technologies. We envision three primary initiatives would move this goal forward:

1. A thoughtfully-equipped open laboratory for students and faculty to experiment with the latest XR tools and technologies in a variety of ways, supported by technical staff and, potentially, the Library. This facility could also offer hackathons, tutorials, and workshops organized by staff, student clubs, and vendors, in addition to self-directed learning opportunities. This laboratory might also be an attractive philanthropic opportunity for industry.
2. A curricular support initiative by OID that supports and promotes the use of XR across all facets of undergraduate education and directly funds the development of new courses.
3. Consideration of an interdepartmental undergraduate set of courses in XR that enables interested students from any discipline to engage with this new area of excellence. If XR is to be a campus priority, the development of a cross-disciplinary cluster course for freshman could also be a valuable and exciting initiative. Whether or not through the Cluster, we think that a strongly interdisciplinary, 'gateway' course into thinking about XR would be a valuable initiative.

These three initiatives can, we believe, be pursued in parallel to the efforts in Phase 1 and 2 above. They could be developed under the auspices of substantially the same institutional structures, or, alternatively, these initiatives could be integrated into existing campus structures.

Parallel Initiative 2: Faculty growth

Allocate additional funding no later than FY20-21 to support and expand the faculty in areas critical to foundational XR innovations, in areas of focus consistent with the plan.

Finally, we wish to make a particular note about the need for additional FTE and faculty hiring in this space. Certainly, if the campus were to receive a significant philanthropic commitment to launch a major XR Institute, one priority for the Institute would be to continue to attract and fund top faculty talent working in XR. The Institute would seek to fill out UCLA's XR expertise across fields, and make joint appointments of faculty who would be well positioned to contribute across disciplines. However, even in the earlier phases of this initiative, we believe a few strategic hires would build out UCLA's capacity to be a leader of this global field. As we saw on the task force, and through the results of our campus-wide survey, there are already a number of faculty on campus well poised to develop and lead XR initiatives and to take advantage of early stage seed-grant funding. However, UCLA can support this cohort with faculty appointments in areas critical to foundational XR innovations. For example, as we mention above, we hope that there will be faculty expansion in areas within the Samueli School of Engineering with strong connections to XR, such as human-computer interaction and graphics. In addition, a moderate amount of campus support might be dedicated to encourage departments to value cutting-edge XR research in faculty hiring, and we therefore do think there would be payoff to dedicating some early stage funding to appointments of faculty at the leading-edge of this field. However, if pushed to hard choices in Phase One, we are more enthusiastic about using limited resources to support cross-disciplinary research and engagement within our current faculty than to see those same resources supporting a very small number of additional hires.

Conclusion

The task force has appreciated the opportunity to explore current work in the field of XR across UCLA and, to a lesser extent, at our peer schools, and emerges confident that XR technology will be formative for the universities of the future. Our dual strengths in the arts and in the health sciences, as well as in a variety of related fields is a combination that is, we believe, both relatively unusual and potentially exciting. There are significant opportunities for UCLA to play a leadership role in this cutting-edge field, and the task force recommends that we aim high and develop the groundwork and planning necessary to draw substantial funding for XR research and scholarship at UCLA. At the same time, if we wish to become a leader in the

area, UCLA cannot wait for this funding to emerge. We therefore recommend a thoughtful investment by central campus, or with philanthropic resources that can be developed with speed, in order to bring Phase One of this proposal to fruition. In essence, Phase One is an XR Institute incubator, aiming to spur impact and excitement for XR research. Our hope is that Phase One can seed not only exciting research into XR, but can, through its success, spur the philanthropic investment and campus-wide engagement that will make a substantial XR Institute feasible and real.

APPENDIX A: RESULTS OF FACULTY SURVEY CONDUCTED BY VR TASK FORCE, FALL 2018

Your information:		Department and/or Unit:	Briefly describe the main areas of VR or AR research in which you are interested.			If you have a link to a website relevant to your VR/AR work, please include that link here.	If you would like to share your CV (preferably with your AR/VR work highlighted) , please upload here. (DOC or PDF preferred)
Name:	**Title :**		**Primary area of interest:**	**Additional area of interest:**	**Additional area of interest:**		
Dr. Deborah Landis	Professor	TFT	museum exhibitions				
Dale Cohen	Director, Documentary Film Legal Clinic	Law	VR Filmmaking	Ethics and Law relating to VR journalism			
Brennan Spiegel	Director of Health Services Research, Cedars-Sinai; Assistant Dean, DGSOM	Medicine	Healthcare			www.virtualmedicine.health	
Randolph H Steadman	Professor and Vice Chair for Education; Director, UCLA Simulation Center	Anesthesiology	Undergraduate and graduate medical education, continuing medical education	Research on effectiveness and application			
Robin Feldman	Visiting Professor		Artificial Intelligence				Feldman cv .docx
Becky Smith	Vice Chair & Head of Production	Film School - Production/Directing Program	VR & AR				DirectingResume BeckySmith 2018.pdf
Eugene Volokh	Professor of Law	School of Law	How VR will change society	Law and VR and AR		https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2933867	cv vr.doc
David Nimmer	Professor from Practice	School of Law	Artificial intelligence	Singularity			
Mario F. Mendez, MD,PhD	Professor	Neurology	VR for socioemotional assessment of frontotemporal dementia	VR for visuospatial assessment of Alzheimer's disease			
Casey Reas	Professor	Design Media Arts	Generative Animation	Generative Environments			
Mayumi Prins, PhD	Professor	Neurosurgery	concussion rehab	TBI cognitive deficits assessment	teaching neuroanatomy		
Rebecca Allen	Professor	Design Media Arts	To develop new artistic works and areas of research involving virtual and augmented reality.	Currently working with UCLA Neuroscience Research and Brain Mapping Center to develop innovative applications for understanding and teaching brain anatomy utilizing VR and AR.		rebeccaallen.com	RA Short BIO-CV.docx
Joseph Shirk	MD	Urology	Medical imaging	Medical education		ceevra.com	
Erkki Huhtamo	Professor	Design Media Arts / Film, Television, Dital Media	Media archaeology of both VR and AR	History of immersive media	3-D as a topos, formula repeated across history		
Lixia Zhang	Professor	computer science	system support for AR/VR			http://ice-ar.named-data.net/	

Your information:		Department and/or Unit:	Briefly describe the main areas of VR or AR research in which you are interested.			If you have a link to a website relevant to your VR/AR work, please include that link here.	If you would like to share your CV (preferably with your AR/VR work highlighted) , please upload here. (DOC or PDF preferred)
Name:	**Title :**		**Primary area of interest:**	**Additional area of interest:**	**Additional area of interest:**		
Eddo Stern	Professor	Design Media Arts	VR / AR and Games	The potential for AR as a creative medium for media art		http://eddostern.com/	
Michelle Erai	Assistant Professor	Gender Studies	Optics	Gender	Race		
Tina Chang	Director of Strategic Program Development	Dean's Office	Digital Storytelling	Product Management (manage AR/VR app development process)		https://www.uclaextension.edu/public/category/courseCategoryCertificateProfile.do?method=load&certificateId=156330358	
David Cho	Fellow (soon to be Clinical Instructor at UCLA)	Cardiology	pain and anxiety control	user interface and interaction design		https://clinicaltrials.gov/ct2/show/NCT03490903?term=NCT03490903&rank=1	CURRICULUM VITAE UCLA ACADEMIC.docx
Pascale Cohen-Olivar	Program Director, Entertainment Studies	Arts/ UCLA Extension	Training filmmakers on VR/AR projects				
Veronica Santos	Assoc. Prof.	Mechanical and Aerospace Engineering	VR/AR-enabled training with applications for human-robot teaming, manufacturing, etc.			http://BiomechatronicsLab.ucla.edu	
Rachel Grazer	Student Affairs Officer	UCLA Extension-Pathway	Optimizing student experience if they can't be on campus	Creating immersive environments for students to learn and explore	Potential AR uses for medicine, design, architecture, and so much more		
Scott Hutchinson	Program Director	UCLA Extension, Arts	Applied Research through classes and events in AR VR MR xR	Bringing in luminaries to discuss area through 'designdisrupt' events and TEDxUCLA	AIGA events	uclaextension.edu	
Brenda Izzi	CAO	Radiology	Onboarding and Annual Education				
Sheila King	Program Director	Humanities and Sciences	Psychology	Biomechanics		NA	
Greg Lynn	Professor	Architecture	architecture	design	mobility	https://archpaper.com/2016/06/microsoft-hololens-greg-lynn-venice-biennale/	
Jungseock Joo	Assistant Professor	Communication	Human - AI (robots) Interaction				
Jesse Rissman	Assistant Professor	Psychology	Virtual reality as a tool to study learning and memory				Rissman CV 2018 (VR activities highlighted).pdf
Steve Anderson	Professor of Digital Media	School of Theater, Film & TV	VR/AR in experimental media art	VR/AR for documentary and social impact	VR/AR in digital humanities research	http://technocinema.net	

Your information:		Department and/or Unit:	Briefly describe the main areas of VR or AR research in which you are interested.			If you have a link to a website relevant to your VR/AR work, please include that link here.	If you would like to share your CV (preferably with your AR/VR work highlighted) , please upload here. (DOC or PDF preferred)
Name:	**Title :**		**Primary area of interest:**	**Additional area of interest:**	**Additional area of interest:**		
Rachel Lee	Director and Professor	Director, Center for the Study of Women & Professor, English, Gender Studies, and Institute for Society and Genetics	VR as an educational tool			https://csw.ucla.edu/event/feminism-senses-nonny-de-la-pena/	
Michelle Craske	Distinguished Professor	Psychology	treatment for depression--anhedonia				craskecv0318.doc
Robert B. Trelease Ph.D.	Adjunct Professor	Pathology and Laboratory Medicine	Application of VR methods for teaching anatomy (pioneer of "virtual anatomy" 1986-present)	Transformation of medical imaging for VR learning objects, mobile development, web-based systems	Artificial Intelligence, neural networks, and machine learning applied to biology, anatomy, clinical reasoning	http://anatlab.medsch.ucla.edu/	TreleaseDossierCV-Biblio_2018HL.pdf
Charles Taylor	Research Professor	Ecology and Evolutionary Biology	outreach in the context of art | science			http://birdsongdiamond.com then link to "immersive"	
Aparna Sridhar	Assistant Professor	Obstetrics and Gynecology	Pain and anxiety management for GYN procedures			none	
Srinivas Sadda	Professor-in-residence	Ophthalmology	AR applications for use in eye surgery and procedures (integrated HUD)	VR applications for display and manipulation of ocular diagnostic data			
Douglas Bell	Prof in Res	Medicine and CTSI	Visualizing data on patient populations derived from electronic health records	Visualizing potential results of alternative decisions			
Omer Liran	MD	Psychiatry	Improving adherence to medications using VR.	Studying the neural correlates of reward and punishment using VR.	Improving empathy for people with mental illness and reducing stigma.		cv.pdf
Paul Barber	Professor	Ecology and Evolutionary Biology	potentially education, but I'm not doing anything in this space currently				
Isaac Yang	Assoc Prof	Neurosurgery	neurosurgery	anatomy	teaching		
James Lister	Assistant Professor	Pathology/Division of Integrative Anatomy	I am interested in producing anatomy models in VR and/or AR in the future.			https://sketchfab.com/jplister	
Yichen Ding	Assistant Project Scientist	Medicine	Biomedical imaging	Education	Surgical plan	https://insight.jci.org/articles/view/97180	CV_Yichen Ding.pdf

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Name:	**Title :**		**Primary area of interest:**	**Additional area of interest:**	**Additional area of interest:**		
Andrew Charles	Professor, Director UCLA Goldberg Migraine Program	Neurology	Therapeutic intervention for migraine and apin				
Nanthia Suthana	Assistant Professor	Psychiatry / Neurosurgery	Memory	Spatial Navigation	Cognitive Neuroscience	http://lonn.semel.ucla.edu/?page_id=56	
Irene Koolwijk		General Pediatrics/Developmental-Behavioral Pediatrics	education	ADHD			
Catherine Carpenter	Adjunct Professor	Medicine/Clinical Nutrition	online delivery of coursework, Human Anatomy and Human Physiology	developing capacity to visualize physiologic mechanisms and anatomical movement within lecture material		https://ccle.ucla.edu/course/view/171A-NURSING13-2	
Sean young	Associate prof	Family Medicine	Worked on VR simulator sickness and games at NASA	Built VR headsets and testing using games for Health behavior change/smoking		Predictiontechnology.ucla.edu, seanyoungphd.com	
Frank Pajonk	Prof	Radiation Oncology	3D Visualization of cells, molecules, ressearch results				
Julian Martinez	Associate Professor	Human Genetics and Pediatrics	Implemnetation in clinical care				
Siamak Rahman	Clinical professor	Anesthesiology and Perioperative Medicine	Distraction method for pain management	Biofeedback supported by VR			
Aria Fallah	Assistant Professor	Neurosurgery	Pediatric Neurosurgery	Epilepsy Surgery		https://www.youtube.com/watch?v=FOo1g5nT7j4&t=52s	
Frank Petrigliano	Associate Professor	Orthopaedic Surgery	Surgical Training	Product Development		http://ossovr.com/	
Gina Kim	Professor	TFT	VR filmmaking for social justice	AR		http://www.ginakimfilms.com/filmography/#/bloodless-2017/	KIM_CV_VR_2018.pdf
Matthew Lieberman	Professor	Psychology	Neuroimaging				0 CV.doc
Songwu Lu	Professor	Computer Science Department	Mobile and wireless Internet	network security	mobile systems	http://metro.cs.ucla.edu/mobileVR.html	
Daniel Fessler	Effects of threat on cognition	Anthropology	In my lab we use VR as a powerful means of eliciting emotion				
Benjamin Radd	Lecturer	Political Science	Diplomacy	Law	Crisis management		
Neil Malamuth	Professor	Communication	Sexual coercion/aggression				
Davide Panagia	Associate Professor	Political Science	VR/AR and algorithmic governance	deep fake	machine learning & population management	http://www.contrivers.org/articles/40/Davide-Panagia-Caglar-Koseoglu-Datapolik-Interview-Political-Theory/	
Dave Shepard	Academic Developer	Center for Digital Humanities	Archaeological reconstruction	VR for museums		ih.cdh.ucla.edu:9000	

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Name:	**Title :**		**Primary area of interest:**	**Additional area of interest:**	**Additional area of interest:**		
Doug Daniels	Coordinator of Scholarly Innovation Technologies	Library Digital Initiatives and IT	Preservation	Pedagogy	Publication	http://archvr.ucla.edu/	
Michael Osman	Associate Professor	Architecture and Urban Design	Construction documents				
Jennifer Steinkamp	Professor	Design Media Arts	contemporary art	media art		jsteinkamp.com/html/you.htm	
Warren S. Grundfest, MD, FACS	Professor Bioengineering, Electrical Engineering, & Surgery	CASIT	VR	AR	Surgical simulation		
Song-Chun Zhu	Professor	Statistics and Computer Science	Computer Vision, Cognition, Robotics and AI	Machine/Statistical learning		http://vcla.stat.ucla.edu/projects.html	zhu_dossier.pdf
Sungtaek Ju	Professor	Mechanical and Aerospace Engineering	Use of AR/VR in laboratory education	Use of AR in thermal management/inspection			
Laurent Pilon	Professor	Mechanical and Aerospace Engineering	light transfer	hyperspectral imaging		www.seas.ucla.edu/~pilon	
Jason Cong	Distinguished Chancellor's Professor	Computer Science	accelerated computing for AR/VR applications	energy-efficient computing		https://www.cs.ucla.edu/augmented-reality-making-it-secure-fast-efficient-and-resilient/	
Tzung	Process of Medicine and Bioengineering	Medicine and Bioengineering	Integrating Light-Sheet Imaging and VR for heart development	Cardiac mechanics for deep learning	Microbiota and heart diseae via deep learning	Ding, Hsiai, et al., Journal of Clincal Investigation Insight, 2017	
Lei He	Professor	Electric and Computer Engineering	portable hardware for VR or AR			eda.ee.ucla.edu	
Paul Eggert	Senior Lecturer SOE	Computer Science	Use of VR and AR in computer science education	3D and VR/AR software infrastructure		https://docs.google.com/presentation/d/1sdTf4EkZWLAuKcD4Gz8aFxW-YSvmvRoZ3eZSyuCAnEs/edit#slide=id.p11	
Francis F. Chen	Professor	EE	Physics	Plasma physics			

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Dr. Deborah Landis	Science Fiction and the Human Imagination	10/20-2023	Science Museum, London	Expansive science/science fiction exhibition								
Dale Cohen	Ethical guidelines for VR Documentaries	2d half of 2017-2018	WGBH/FRONT LINE for the Knight Foundation	Drafted set of guidelines for VR report soon to be published								
Brennan Spiegel	Too many to list here. See our website for details.											
Randolph H Steadman	Fire in the Operating Room	Current, begun winter 2018	Under negotiation	VR for teaching prevention and management of fire in the operating room	Teamwork training	Current Dept of Defense grant	$1.1M	Current project is screen-based simulation; however, we have plans to convert to VR	Augmented reality for medical training	Pending	N/A	Partnering with Logos to develop AR medical training content
Robin Feldman	No Response											
Becky Smith	No Response											
Eugene Volokh	Law, Virtual Reality, and Augmented Reality	To be published in 2018, U. Pennsylvania Law Review	Faculty Support Account, about $3000	New legal problems that virtual reality and augmented reality will likely create, and tentative thoughts on how to deal with them.	Our Virtual Reality Future	2016-present	Faculty Support Account	How VR will change work, social life, family life, religion, education, tourism, entertainment, and even sex.				

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David Nimmer	Horace S. Manges Lecture, Columbia Law School	To be delivered Spring 2019		I will address the copyright implications of AI in an annual endowed lecture.								
Mario F. Mendez, MD,PhD	Virtual reality for the assessment of Frontotemporal Dementia	2015	NIA .. as part of R01	Interpersonal engagement of patients with disease affecting the social brain								
Casey Reas	No Response											
Mayumi Prins, PhD	No Response											
Rebecca Allen	INSIDE	2016	art grant	INSIDE is an interactive virtual reality art experience utilizing MRI data of the brain that explores the inner world of the brain, the connection between virtual and real humans, and the sensation when immersed in artificial nature.	The Puzzling Brain	2017	Funding from Dr. Roger Woods, director UCLA Brain Mapping Center	The Puzzling Brain is a prototype of a method to teach brain anatomy using interactive VR.	Various research and art projects involving VR and AR	1992 - 2017	various	I've worked as an artist and director of research in various labs to develop innovative VR and AR tools, technologies and art works.
Joseph Shirk	Ceevra	1/2016-present	Venture funding	CT to VR imaging platform for surgical planning	Use of 3D VR imaging for robotic partial nephrectomy	3/2016-6/2016		Single arm trial using VR images to plan robotic partial nephrectomy	Use of 3D VR imaging for nephrectomy	9/2017-present	Venture funding and institutional	Multi-institutional trial using VR images for nephrectomy

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Erkki Huhtamo	Many of my publication deal with immediaive media, from example book Illusions in Motion (2013, Mit Press)	2013		Book								
Lixia Zhang	ICN-Enabled Secure Edge Networking with Augmented Reality (ICE-AR)	September 1, 2017 - August 31, 2020	NSF, Intel	The ICE-AR project aims to develop a new wireless network architecture to address security and performance limitations in today's systems, to provide pervasive support for emerging AR applications.								
Eddo Stern	Darkgame	2006-2014	$ 100,000 Various sources (including a UCL a TSG and a Creative Capital Grant)	sensory deprivation game using custom hardware	Wizard Takes All	2011	$20,000 art Commission for a new media festival in Houston	Augmented reality game / live performance	Flatland Arg!!!	2010	$100,000 Nokia	Augmented Reality Game and tracking technology using Nokia Tablets
Michelle Erai	Colonial Optics, first manuscript		UCLA research finds	Examining colonial ideologies in images of Maori women.								

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Tina Chang	Digital Storytelling and Multi-Platform Strategy Specialization	Launched 9/2017	n/a	Three course program that explores digital content creation, social media and digital marketing, and AR/VR.	Product Management Specialization	Launched 4/2018	n/a	Two course program that focuses on the strategic and tactical sides of product management.				

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David Cho	Coronary Angiography THerapeutic Virtual Reality: Investigating the Effect of Virtual Reality on Procedural Anxiety, Pain and Vasospasm	05/2018 - 6/2018	self	The CATH-VR study will investigate the effect of virtual reality (VR) on patient pain, anxiety, and radial artery vasospasm during coronary angiography. Our hypothesis is that the use of VR will decrease patient anxiety and pain via validated scoring systems, as well as show a low rate of vasospasm of the radial artery. In addition, we hypothesize that the amount of opioid and benzodiazepine medications utilized for procedural sedation will be lower in the intervention arm. VR has gained recent attraction as an alternative or adjunctive treatment option for pain....								

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Pascale Cohen-Olivar	Course in VR Storytelling workshop	Fall 2017	The unit purchased 4 Samsung cameras and the instructor lent more software/harware	Students make a short VR film project using Samsung cameras and stitching software and learn about the basics of VR storytelling	Understanding the Nature of VR/AR - overview course	Winter 2018	Student fee only	Overview on how VR/AR/MR is created; hardware and software is demonstrated throughout the course				
Veronica Santos	No Response											
Rachel Grazer	Project THETA 360	April 2016-June 2017	UCLA Extension IDLS	A Pathway student with Autism tested how UCLA Extension could use a THETA 360 camera to improve student experience.								
Scott Hutchinson	AR VR for Immersive Content	Spring Quarter	Regular UCLAx class	Part of Game specialization	UX for Games	Spring	Regular UCLAx class	UX related to Game and VR	Game Engines: Unity	Winter	Regular UCLAx class	Game engines (related to VR)
Brenda Izzi	Siemens Collaboration on MR Safety VR Training Tool	Oct 2017 to present	none	Siemens is creating a VR MR safety training tool and we are reviewing it for accuracy and usefulness								
Sheila King	No Response											

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Greg Lynn	w/Trimble was one of the first 3 pilot partners for Microsoft HoloLens: 00:49 - 01:07 https://vimeo.com/203266163	2015-2017	Microsoft $30,000 and gift HoloLens & UCLA PhD Researchers	used HoloLens for the development of Packard Plant project and then had 2 HoloLens on display for visitors in US Pavilion at Venice Biennale	Piaggio Fast Forward gita	2016-present		daily use of HoloLens as a design tool				
Jungseock Joo	Human-agent interaction for optimizing agent action	2016/09-	start up fund (-$5000)	Use VR to emulate an environment in which virtual agents will learn from human via interactions								
Jesse Rissman	Giving classic learning principles a virtual makeover: Neural correlates of effective retrieval of memories formed in a virtual world	8/1/13 - 1/31/17	$498,130	This project uses innovative behavioral and fMRI methods to characterize how virtual learning environments can provide rich contextual support so as to minimize inference between potentially confusable domains of knowledge and provide cues to facilitate recall of critical information.								

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Steve Anderson	Oculus NextGen Program	July 2017-present	Technology donation approx. $85,000	develop classes and support lab for VR within TFT	Google Daydream Impact program	May 2018 - December 2018	Equipment loan: Google Odyssey, Jump + Daydream	Develop non-narrative VR + S3D 360 video content	VirtualX	Winter-Spring 2018	UCLA BruinX / Office of EDI	VR experience for Orientation Week
Rachel Lee	Feminism + the Senses lecture featuring Nonny de la Pena, "Immersive Journalism, Breaking the Frame, and the Gender Struggle in Virtual Reality"	November 13, 2017	$5,880.56 (from center funds, co-sponsorship, gift)	https://csw.ucla.edu/event/feminism-senses-nonny-de-la-pena/								
Michelle Craske	Virtual Reality and Anhedonia	10/12/2016-present	Ahmanson-Lovelace Brain Mapping Center Pilot Award	We are investigating the use of VR (via Oculus Rift) for the treatment of depression.	Mobile Virtual Positive Experiences for Anhedonia	1/2/2018-present	UCLA Life Sciences Campaign Board: Innovation Fund Award: $25,000	We are investigating mobile virtual reality applications for the treatment of depression.	Cholinergic Decontextualization of Exposure Therapy for Anxiety	9/11/2013 – 6/30/2017	NIH/NIMH (R34): $231,000	We utilized VR scenes to help individuals with fears of public speaking.

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Robert B. Trelease Ph.D.	Virtual Anatomy	July 1986 to present	self-funded	Developed interactive 3D models and methods for teaching human gross and microscopic anatomy, using available specimens and later medical imaging sources, first for PCs, then for web-based and mobile devices use.	Development of Qualitative Process Modeling Systems for Cytokines, Cell Adhesion Molecules and Gene Regulation	1/1/97-2/28/98	Air Force Office of Scientific Research $25,000	Develop and implement an AI-based qualitative process modeling system for representing immune responses in wound healing.				
Charles Taylor	Ars Electronica Deep Space	2017	supported by NSF and others. Outreach segment of $2M	Immerse user into world of birds, with emphasis of acoustic environment. see http://birdsongdiamond.com/ars-electronica/	Birdsong Diamond Japan in Univ. Tsukuba Large Space	2016	supported by NSF and others. Outreach segment of $2M	Immerse user into world of birds, with emphasis of acoustic environment. see http://birdsongdiamond.com/university-of-tsukuba/	Bird Song Diamond in Deep Space 8k John Brumley, Charles Taylor, Reiji Suzuki, Takashi Ikegami, Victoria Vesna, Hiroo Iwata			This is a write-up. I believe it has been submitted for publication, but am not certain of the status
Aparna Sridhar	VR for anxiety reduction for first trimester D&C in office under local anesthesia	Ongoing	Society of Family Planning $7500	A feasibility study to understand if we can use VR during dilation and curettage procedure								
Srinivas Sadda	No Response											

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Douglas Bell	Developing a "DataGuide" Dashboard for Exploring EHR Data		No specific funding yet (3.5M grant rejected)	We are creating an interactive dashboard where data users can explore existing data, view metadata comments, and ask data administrators about possible anomalies								

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Omer Liran	Using Virtual Reality to Improve Medication Adherence in the Treatment of HIV.	February 2018 to Present	Self funded	Using Virtual Reality to improve medication adherence rates in HIV positive individuals.	Increasing Empathy and Decreasing Stigma for Schizophrenia Using Augmented Reality.	March 2018 to Present	Self funded	Using an Augmented Reality Schizophrenia Simulator to improve empathy for people with schizophrenia and decrease stigma for schizophrenia.	Amygdala Signaling in Anticipation of Reward in Hazardous Environment	Jan 2017 to Present	Funding through Rutgers University	In collaboration with Rutgers University, studying amygdalar and posterior cingulate function at the neuronal level. We are recording amygdalar activity using implanted electrodes in patients preparing for brain surgery while putting them inside a Virtual Reality environment designed to simulate rewards vs hazards.
Paul Barber	No Response											
Isaac Yang	No Response											
James Lister	No Response											

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Yichen Ding	Navigating through the myocardial ridges	4/2017	NIH R01	we demonstrated the VR-LSFM hybrid for revealing the endocardiac trabecular network in the transgenic (cmlc2-gfp–transgenic) adult zebrafish.	Elucidating the spatial distribution of exogenous potassium channels	4/2017	NIH R01	We applied VR-LSFM to detect the myocardial-specific expression of exogenous renal outer medullary potassium channels in the adult mouse following gene therapy.	Demonstrating 4D VR application for cardiac contractile function	6/2017	NIH R01	We implemented the mobile VR-LSFM platform for the 4D contracting heart in the transgenic Tg(cmlc2:gfp) zebrafish model.
Andrew Charles	Virtual Reality Approaches to Therapy for Migraine and Pain	Ongoing, indefinite	UCLA Goldberg Migraine Endowments	Developing virtual reality approaches as acute and preventive therapies for migraine and pain								
Nanthia Suthana	Neurostimulation and Recording of Real World Spatial Navigation in Humans	09/25/17-09/24/20	$3,269,102 ($2,122,793 direct costs)	Combining wireless motion capture and virtual reality technology in participants with brain implants to study the neural correlates of real world spatial navigation								

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Irene Koolwijk	Teaching ADHD Guidelines	Doing Medical Education Fellowship related to this project from Sept 2017	no funding	On line development of interactive module on teaching residents ADHD recognition and management								
Catherine Carpenter	Development of online Human Anatomy Course (N13) for School of Nursing	2016 to present	School of Nursing- release salary time to develop	Developed an online Anatomy course for undergraduates available during Summer School	Development of online Human Physiology course (N3) for School of Nursing	2016 to present	School of Nursing, $10,000k					
Sean young	Simulator sickness in virtual environments	1/2002-2006	NASA		Developing and testing VR apps for health behavior change	11/2015-present						
Frank Pajonk	No Response											
Julian Martinez	No Response											
Siamak Rahman	N/A											
Aria Fallah	No Response											
Frank Petrigliano	No Response											

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Gina Kim	Bloodless	August, 2017	Total budget 200,000 (in kind donation from Venta VR, etc-please see the CV for the full list)	Bloodless is a 12minute VR film that deals with camp town sex workers for US army stationed in South Korea since the 1950s. The film traces the last living moments of a real-life sex worker who was brutally murdered by a US soldier at the Dongducheon Camptown in South Korea in 1992. Portraying the last hours of her life in the camp town, the VR film transposes a historical and political issue into a personal and concrete experience. This film was shot on location where the crime took place, bringing to light ongoing experiences...	Monkey House	2019	LACMA (in consideration), Venta VR, Dankook University in Korea	Monkey House is a Virtual Reality film that portrays the untold history of Korean comfort women who served the US military stationed in South Korea. In particular, it focuses on these women's memories and voices trapped within a detainment center...	Sound map of LA	2019	TBD	Visiting the sites of gender crimes and domestic violence in LA, reenacting the scene with sound only.
Matthew Lieberman	No Response											

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Songwu Lu	Mobile VR/AR	2017 - Present	N/A	Identify the 4G network bottleneck to enable VR/AR and propose solutions	Information-centric networking for AR/VR	2017-Present	NSF and Intel	Explore information-centric networking to support AR/VR over edge computing				
Daniel Fessler	Effects of threat on attitudes toward enemies and allies	Ongoing	US Air Force Office of Scientific Research (part of a much larger grant)	We use VR depictions of active-shooter events to elicit threat-related cognitions concerning the attributes of allies and enemies	Effects of threat on negatively-biased credulity	Ongoing	P.I.'s R&R	We use VR depictions of active-shooter events to elicit threat-related cognitions concerning credulity toward information concerning hazards or benefits				
Benjamin Radd	Situation Room Experience	2016-17	Private donors	Scripting and designing second "Situation Room Experience" at the Ronald Reagan Library								

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Neil Malamuth	Using VR intervention with college men at high risk for sexual aggression	Proposed	None yet	A published VR approach to increasing effectiveness of sexual assault intervention has already been published. We are interested in researching it's effectiveness compared to conventional interventions, which in a forthcoming publication we show have not worked and may actually be detrimental to high risk males.								
Davide Panagia	#datapolitik	Current	N/A	study of algorithm as medium for everyday governance								
Dave Shepard	Immersive Humanities	4/2015-4/2018	Various	Web and HTC Vive viewer and authoring interface for Egyptian coffins								
Doug Daniels	Immersive Humanities	Ongoing	N/A									
Michael Osman	No Response											
Jennifer Steinkamp	You	2016	Rhizome.org, minimal	AR vanitas mirror								

	Please list up to three example/examples of specific VR or AR projects in which you are, or have been engaged.											
Name:	**1. Title of Project:**	**Dates of Project:**	**Funding Source and Amount:**	**Brief Description of Project:**	**2. Title of Project:**	**Dates of Project:**	**Funding Source and Amount:**	**Brief Description of Project:**	**3. Title of Project:**	**Dates of Project:**	**Funding Source and Amount:**	**Brief Description of Project:**
Warren S. Grundfest, MD, FACS	Virtual Tissue Modeling Project	2015 - Present	DoD	Developing realistic models of liver and other organs for future simulations	Combined Haptic Feedback and Vibro Tactile Feedback For Surgical Applications	2014 - Present	Various NIH grants	This project evaluates a combination of haptic and vibro tactile feedback in the same device to restore sensation during laparoscopic surgery	Differential Haptic Feedback For Minimally Invasive Surgical Tools	2017 - Present	NIH	Evaluates various feedback mechanisms to improve surgical sensation during procedures, specifically to assist during knot tying to prevent suture breakage and during manipulation of bowel to prevent crush injury.
Song-Chun Zhu	No Response											
Sungtaek Ju	No Response											

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Laurent Pilon	image distortion caused by droplets	1/1/2016-present	China Scholarship Council (~$100,000)	Develop algorithm to correct the distortion of droplets on windows or in the air.	Light transfer in absorbing and scattering media	for the last 10 years	various (NIH, NSF, DOE, European Union)	Develop experimental apparatus and algorithms to study light transfer in absorbing and scattering media (human skin, foams, particle suspensions, remote sensing).	Efficient Multi-Scale Radiation Transport Modeling	February 1, 2009 – January 31, 2011	US Air Force - $1M with UCLA portion of $150,000	Develop algorithm to solve light transfer in absorption and scattering media using Graphics Processing Units (GPU).
Jason Cong	ICN-Enabled Secure Edge Networking with Augmented Reality	7/2017 - 6/2020	NSF and Intel Corporation									
Tzung	Light-sheet Imaging and shear stress for modulating cardiac trabeculation	2014-2019	NIH	Integrating 4-D light sheet imaging with interactive experience for cardiac development								
Lei He	No Response											

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Paul Eggert	Multiplayer Framework	April-June 2018	none	Unet and Steamworks SDK for matchmaking and communication	Audio Beat Map	April-June 2018	none	Generate game-ready beat maps from audio files				
Francis F. Chen	No Response											

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Dr. Deborah Landis	AV & VR are at best teaching tools. UCLA has an opportunity to expand their use in/as the classroom	Isolation need not define this new area of engineering and shared experience may be the best way forward	Journey and discovery are an essential part of learning. I don't expect that we will get further faster with this new tool. Is this a hovercraft?	
Dale Cohen		Need for familiarity with capabilities of the tech and the cost of purchasing/using the tech		
Brennan Spiegel	I've written extensively about this; too much for survey. See www.virtualmedicine.health/blog and www.virtualmedicine.health/press	See: www.virtualmedicine.health/blog	See above.	We recently held a sold out conference on this topic: www.virtualmedicine.health
Randolph H Steadman	Development of medical training content	Partnering with industry in a way that's favorable for UCLA.	See above	VR and AR are likely to be featured extensively in future simulation-based medical training.

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Robin Feldman		Academic research tends to concentrated in silos. Interdisciplinary approaches that connect scientific researchers with legal and policy analysts are important.	VR and AR are related categories to the broader topic of artificial intelligence, which is an area of focus for my work. I have recently participated in the GAO's preparation of a report to Congress on "Artificial Intelligence: Emerging Opportunities, Challenges and Implications", the Army Cyber Institute's threat casting exercise on weaponization of data, and the National Academies of Sciences roundtable on "Artificial Intelligence and Machine Learning to Accelerate Translational Research." I also have academic articles forthcoming on these topics. In addition, I also come across these issues with my program, the Startup Legal Garage, in which students perform free legal work for 60 early-stage technology and life science companies each year, with the work supervised for free by outside Law Firms.	
Becky Smith	I haven't used VR or AR yet as a feature & documentary filmmaker but I am deeply intrigued & want to get more involved.	We have a new professor, Steve Anderson, in the film school and he has begun to introduce us to the possibilities - but it's a matter of time and money.	I want to integrate VR/AR into my feature films and my documentary films. I want to be able to understand the possibilities and pass this information along to my students.	

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Eugene Volokh	The key to VR really making a difference is the development of avatars that look like us and that copy our facial expressions, so that we can interact as us (rather than as cartoons) in VR.			
David Nimmer	No Reponse			
Mario F. Mendez, MD,PhD	socioemotional and cognitive assessment of neurological and psychiatric patients	no		
Casey Reas	VR and AR have a long history in my field, Media Arts, with a huge push during the 1990s. The current field of hardware makes is possible for a much wider range of students, artists, and designers to explore this area. The most important elements for my interests are high-resolution screens, excellent motion tracking, and comfortable hardware. Our students are excellent at creating media (3D models, generative graphics, etc.)		I plan to work in VR, but I haven't done so yet. I spend time in VR to explore the state of the art.	
Mayumi Prins, PhD			We are working with Nanthia Suthana who is in Neurosurgery with the hope of starting to develop VR for concussion related rehabilitation. Programmers are a rate limiting step and funding has not been acquired yet.	
Rebecca Allen	Yes, but need to send this info later.			

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Joseph Shirk		Lack of collaborative environment currently in this field at UCLA	N/a	
Erkki Huhtamo	I am interested in media history. I will leave the future for futurologists.			It is astonishing to see how currect VR and AR industries and businesses try to "forget" their own pasts. It really is a smoke screen rather than ignorance I think (hope). Their novelty is relative. In many cases the issues and motives they raise go back hundreds of years. My next book "Dismantling the Fairy-Engine" has several chapters about that.
Lixia Zhang	UCLA has been leading the development of a new Internet architecture dubbed Named Data Networking (NDN) since 2010 (http://named-data.net/). NDN is well suited to enable pervasive AR applications.	The NDN team is largely made of system people. We look for opportunities to work with people on AR app development.		

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Eddo Stern	AR is primed to become a dominant consumer technology and has endless potential uses. I am more skeptical about VR's potential as a mass medium - its technological features and limitations run counter to certain trends in the way specifically specialized computer hardware is adopted, and the general trend in computer gaming to free the user/player from physical constraints. I think AR on the other hand ha s a bright future is a technology that is sure to be mainstream.	Yes - lots of new hype around VR with out a good understanding of lessons learned from its previous "incarnations" about a limitation (caused by hype..) about how it overlaps already with Game Technology Research and Deasign...		I would like to see integration between AR and VR research and Games research. Much of my research in Games and Art over the past 15 years overlaps research in in VR and AR... I would like to be part of the conversation - additionally I have worked as a VR developer in the late 1990s in the VR industry - and have many insights on the field and its potential
Michelle Erai	Wexler's warning: to be careful of the time when our very retina's are pressed into the service of the state.	Limitations in faculty publishing media - no one reads a 300pg single author piece any more.	Given the racist and misogynist histories of visualizing, I am concerned that people receive adequate training in visual literacy so that they can identify mechanisms of capitalism, racism, homophobia in images etc.	The subjects of 'reality,' surveillance, hypervisibility etc have historically been supported by oppressive systems - how will we know them when we're looking at them in the future?
Tina Chang	Teaching students how to lead the iterative design process as product managers as there are a growing number of people interested in AR/VR application development.			

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David Cho	I think that VR has significant potential to bring together the designers/programmers and the clinical staff who can provide real-time/timely feedback to develop software/experiences relevant to medical therapy. Regarding AR, the possibility to simplify patient and/or provider workflows and share information seems to be a great opportunity	Cost - use of VR software developed by 3rd party sources are expensive, and defining clinical and economic value to UCLA Health is not clear		I am excited to work with the task force and bring the cardiology department at UCLA into the conversation!
Pascale Cohen-Olivar	Important to sensitize student to new opportunities in the field. Opportunities to use AR/VR in delivering educational content for artists and filmmakers.	Budgetary concerns - any equipment purchased soon becomes obsolete Lack of facilities		

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Veronica Santos	- VR/AR already has a presence in rehabilitation - VR/AR could be developed for manufacturing applications (e.g. inspection, assembly training) and human-robot teaming		- I do not currently work in VR/AR, but have some developing interest in collaborating with industry to create AR-enabled training systems for workers who perform inspection and assembly work on the manufacturing line. I am pursuing a collaboration opportunity with United Technologies Research Center's Robotics group through the Advanced Robotics for Manufacturing (ARM) Institute (http://arminstitute.org/). - Our most recent related work on eye tracking is aimed at performing action recognition and inference of human intent for human-robot teaming. However, we also have an interest in studying eye movements and gaze fixation during performance of tasks on the manufacturing line.	- Recent paper and video on our eye tracking and machine learning capabilities: "Exploiting Three-Dimensional Gaze Tracking for Action Recognition During Bimanual Manipulation to Enhance Human–Robot Collaboration" (https://www.frontiersin.org/articles/10.3389/frobt.2018.00025/full)
Rachel Grazer	No Response			
Scott Hutchinson	In addition to the specializations and certificate courses teaching core skills, there are huge opportunities in the applications of game in non game areas (GIS, Advertising, Design...)	Main issue is exposure, I'd like to see more open house style, talks, and studio tours, this is how we build up the design program. Also, more partnerships with VR groups, hosting meetups, and more.	Just like designers adding web skills tot heir print skills, they now must add AR VR MR skills, which means there is lots of room for growth and learning in the filed of design	Beyond happy to be part of any workgroups, this is a big part of where we are looking to grow.
Brenda Izzi	No Response			

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Sheila King	I know that there is work being done on anxiety and depression at UCLA led by Professor Michelle G. Craske, Ph.D. at the ADRC. Also, there is work being done using VR in addiction to help with practice in early recovery dealing with situations and cues where others might be using.	NA	NA	
Greg Lynn	Incredible tool for teaching and explaining complex 3D operations. Most amazing manual for explanation ever.	designing or working in AR/VR is not worked out but evaluation, explanation, exhibition and education is the strength of the technology currently		we want to be out front not following in this realm
Jungseock Joo	interdisciplinary explorations that bring together researchers in engineering and communication	insufficient resource (fund, space, etc)		
Jesse Rissman	It would be great to have a shared facility with a 360 'treadmill' (http://www.virtuix.com) so that study participants can actively walk while navigating a virtual world. It would also be very useful to have on-campus developers of VR content and functionality who can be hired on a recharge basis to provide project-specific IT services.	Our biggest impediment has been that many of our participants experience mild to moderate motion sickness while performing our VR tasks with a head-mounted display.		
Steve Anderson	I'm interested in the integration of lens-based and CGI imagery; mixed reality experience with congruent physical-digital spaces; volumetric and S3D 360 video;	Fetishization of proximate futurity rather than current affordances; duplication of efforts in campus silos; no obvious mechanism for communication across units.	That's all I do right now is VR/AR	I would be happy to contribute further to the efforts of the task force.

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Rachel Lee	Though we at the UCLA Center for the Study of Women do not focus or conduct research on VR, we incorporated the work of Nonny de la Pena, deemed the "Godmother of VR," into one of our lecture series in November 2017. It consisted of individual VR screenings of her projects (donated by the TFT Transient Media Lab) and a talk delivered by Nonny. It was a one-time event and very successful.	There do not seem to be many areas to screen VR demos, but the TFT Transient Media Lab was perfect!		
Michelle Craske	No Response			
Robert B. Trelease Ph.D.	Intelligent learning (personalized tutoring) systems employing VR/AR learning objects, integral assessment, and	Paucity of general governmental support for developing new technologies for learning		Spent over 25 years developing new computer-based technologies for curricular support inside the School of Medicine. Pioneered interactive 'virtual anatomy' (see PubMed root for this term), as well as serving as founding Faculty Advisor and Associate Director of the Medical School's Instructional Design and Technology Unit, part of the Dean's Office 1996-2017, responsible for developing and managing the now vital (daily use) web-based curricular resources for the undergraduate medical curriculum. Academic Senate Distinguished Teaching Award, Distinguished Lecturer, 2008.

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Charles Taylor	Victoria Vesna, Prof. in Design and Media Arts, UCLA is the principal on this project. She is a world leader in performance art, and has thought much about your question.			
Aparna Sridhar		Getting an IRB approved was extremely difficult. It took me double the usual time.		
Srinivas Sadda			My lab is primarily focused on image processing and artificial intelligence. I have not done VR/AR work yet, but that is the natural next step with our program. I am excited that we are developing this effort at UCLA.	
Douglas Bell	We have massive amounts of data in electronic health records and we need new ways to make sense of it and to apply what we learn to reduce our uncertainty.	Funding, of course.	I'm currently working only with 2-D graphs (using D3) but we've had ambitions from the start to go 3D/VR. I don't think AR applies in this case.	Support for these efforts and possible collaborations would be great.

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Omer Liran	In the near future, improvements to Augmented Reality devices will provide us with tools that will provide both researchers and educators new frontiers to explore. AR technology becomes especially exciting when combined with new machine learning techniques such as neuronal networks. UCLA can lead the way in this exciting marriage of two new technologies by strengthening and encouraging interdepartmental cooperation. As someone who is both a physician and a programmer specializing in VR, AR, and machine learning, I would be thrilled to help coordinate such efforts.	Working at Olive View-UCLA Medical Center was challenging because of space constraints. Finding the required space for VR/AR experiments continues to be a struggle.		I am a physician and a programmer working on applying VR, AR, and machine learning to novel medical applications. I would love to be deeply involved with the VR/AR task force. Please contact me so that we can discuss further.
Paul Barber	I think that this could be really useful for education in biology, being able to take students "into the field" without leaving the classroom. There is tremendous potential, but I don't know anyone working on this right now.	While useful, I don't see myself or other faculty creating this content. Right now, the only people I know that are doing this are Google.		
Isaac Yang	No Response			

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James Lister		My limitations are: a general lack of knowledge on how to convert my digital assets to VR versions; and a lack of coding skills to generate the apps for viewing VR/AR models. I know where to look to overcome the first limitation, and that's just a matter of me finding the time to sit down and learn how to generate the models with the software I use. My current plan is to host VR models on my sketchfab account, but it would be better to host models locally. I would need a collaborator to build an app for viewing models in VR/AR.	I have been developing digital models for teaching anatomy at the DGSOM and UCLA Dental school, and have been getting good results in enhancing the student learning experience. The next step to elevate these resources would be to move to VR/AR; my ideal concept would be an app that hosted the models in AR, with the ability for students to toggle labels on/off and bring up text boxes with the pertinent information from their curriculum. Recent research has been suggesting that these kinds of resources increase learning outcomes. Since I don't have much coding experience, I would need collaborators to help with such a project, or at least some sort of shared resource at UCLA that could help.	
Yichen Ding	Integrating VR with medical imaging and deep learning is a promising direction to advance translational and clinical studies. UCLA is a great platform to translate our research to address cardiovascular disease.	Unlike traditional VR games or videos, the data of medical VR is from real imaging results. Therefore, building an efficient and robust image segmentation framework is critical to medical VR. We are working with our colleagues at USC to develop this kind of platform.		
Andrew Charles	No Response			

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Nanthia Suthana	VR/AR applications for brain research are vast in addition to translational clinical applications for treatment of neuropsychiatric disorders. UCLA would be perfectly positioned to excel in this area given the strong medical school research programs and technological expertise from School of Engineering and Computer Science. However, on the medical school side there are very few taking advantage of this great opportunity.	The kind of work in my lab requires cross departmental collaborations. For example, my laboratory consists of students and postdocs in electrical engineering, computer science, neuroscience, and physics. In the beginning it was quite a challenge to recruit the lab members since a unique convergence of expertise required. Also, only up until very recently, I found that there was less interest from other Neuroscience and clinical faculty members than I expected. I have opened up my VR lab cost free to other faculty, two of which (Neurosurgeon and Psychiatrist) have been able to use it successfully to acquire pilot data and submit competitive grants. With minimal cost resources perhaps for a programmer, several other laboratories could benefit from my lab's >$100K equipment to get pilot data and become competitive for grants. However, it is currently under utilized and lots of opportunity wasted....		
Irene Koolwijk	educational tools	Just started developing this project, so hard question to answer.	see above description of project	-

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Catherine Carpenter	Visualization of human anatomical movement. Demonstration of real-time physiologic mechanisms. Utilize film school and health sciences to develop.	Expertise and skills. I am limited by my own skill set and availability of time to learn new techniques.	The online Anatomy (N13) and online Physiology course I developed have enormous implications for inclusion of future VR/AR into the courses	
Sean young	No Response			
Frank Pajonk	- Creating VR content for biomedical teaching - Offering courses to teach biomedical students principles of medical animation and VR	- Lack of campus licenses for 3D software - lack of access to render farms		
Julian Martinez	The use of VR in autism: this can be used to promote and track eye contact, social skills, and adaptation to challenging of medical care, like blood draws and imaging	Lack of expertise on campus on translational approaches for implementing these types of technologiesin medical care	We would be open to partnering with experts in the field who have an interest in identifying clinical setting in which VR might be applied	
Siamak Rahman	Use of VR in pain management and anxiety reduction	Billing the patient/ hospital provided system		
Aria Fallah	I think this can be a great tool in selected pediatric neurosurgical cases in order to educated patients/families about the disease process, teach medical students and residents, as well as practice/rehearse difficult operations prior to performing them.	We used to but no longer have access to Virtual Reality Support through our department.		
Frank Petrigliano	No Response			
Gina Kim	Using VR for social justice. https://filmmakermagazine.com/104182-sex-crimes-and-virtual-reality-best-vr-storytelling-of-2017-gina-kims-bloodless/#.WtfxndXwaX0	Promoting empathy without exploitation http://www.koreaherald.com/view.php?ud=20170915000677 http://anthemmagazine.com/vr-trooper-gina-kim/		http://www.huckmagazine.com/perspectives/activism-2/virtual-reality-new-frontier-human-rights-filmmakers/

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Matthew Lieberman			I do mobile neuroimaging using near infrared spectroscopy. While I do not currently use VR/AR, it is an obvious future direction as people can wear VR equipment at the same time they are being scanned with our mobile equipment. Thus I would be interested in being kept in the loop on any VR/AR developments at UCLA.	
Songwu Lu	No Response			
Daniel Fessler	VR has enormous potential for ecologically valid laboratory psychological research	None. If anything, participant enthusiasm is too high!		These projects are all collaborations w/ Prof. Colin Holbrook of UC Merced Cognitive Science. There are many opportunities for UCLA/UCM bridging in this area.
Benjamin Radd				I'm working on an exciting and unique simulation ed-tech startup project that incorporates elements of AR/VR. I would be happy to discuss in person.
Neil Malamuth	No Response			
Davide Panagia			I am intersted in the theoretical and normative implications and expectations of VR/AR for democratic governance.	

Name:	Do you have any brief thoughts to share with the task force about the most exciting near-term developments in VR and AR, broadly defined? We are especially interested in any areas where you believe UCLA could be well poised to excel.	Have you encountered any specific impediments or limitations to working in these areas that you think the task force should know about? If so, please briefly describe below.	If you do not currently work in VR/AR but you expect to in the future, or if your work has implications for VR/AR, please briefly describe below.	Is there any additional information you wish to share with the task force?
Dave Shepard		Funding: we don't always have the funding to pay for developer hours to work on projects. Technial skills: the variety of devices makes programming difficult and some skills hard to come by.		
Doug Daniels	The Library has two Artec scanners, the Space Spider and the Artec Eva. These two scanners can provide the University with a means of digitizing the mind-blowingly extensive collections of artifacts within the Library Special Collections, the Cotsen Institute of Archaeology, and the Fowler Museum, just to name a few. In the Library alone, we have a collection of cuneiform artifacts that could be scanned and then published in a virtual environment.	Time, manpower, and money for equipment.	The Library is currently working with the Cotsen Institute and the Center for Digital Humanities to create a dynamic virtual environment with annotated artifacts. The idea is to have a virtual classroom/museum environment that is populated with artifacts that are housed online in a database that CDH is developing. The idea is that faculty can upload specific artifacts to this database with whatever annotations they want (ie, translating text on a cuneiform tablet), and then pull those artifacts into the virtual environment that we're developing.	The Library has one student that is currently our VR developer. She's interning at JPL over the summer to create a VR environment from the Mars Rover's images. As I mentioned, we also have two scanners in our possession that I am incredibly eager to put to use. We are very well set up to be content creators for VR environments, but we are a bit understaffed and underfunded to create a full-blown VR environment all on our own. Whatever comes of this initiative, I would be very, very, VERY interested in getting involved to help generate some content. We also have a drone, a DJI Phantom 4, along with Pix4D software to do 3D mapping. The difficulty is the bureaucratic red tape involved with flying on campus. But it's just another content creation tool that we have at our disposal to generate content for VR....
Michael Osman	The use of VR/AR on construction sites			

Name:	Do you have any brief thoughts to share with the task force about the most exciting near-term developments in VR and AR, broadly defined? We are especially interested in any areas where you believe UCLA could be well poised to excel.	Have you encountered any specific impediments or limitations to working in these areas that you think the task force should know about? If so, please briefly describe below.	If you do not currently work in VR/AR but you expect to in the future, or if your work has implications for VR/AR, please briefly describe below.	Is there any additional information you wish to share with the task force?
Jennifer Steinkamp	I teach a 3D animation and modeling course, it is very exciting to experience the projects in virtual space	The software and hardware can be complicated, logging on to steam etc.	I imagine I will. I need to develop tools to make objects less stiff while working in real-time.	I feel a real limitation in documenting projects because the experience is so dimensional and video is so flat. My students have been making projects for the past year, I converted the classroom I teach in to accommodate VR, I created many course notes to help the process, Unity, VRTK etc: http://users.design.ucla.edu/~cariesta/spring2017/ http://users.design.ucla.edu/~cariesta//winter2017/ http://users.design.ucla.edu/~cariesta/3DCourseNotes/html/unity_primitives_vr.html
Warren S. Grundfest, MD, FACS	The CASIT lab is specifically designed to excel in developing and training surgeons and others using procedure based VR and AR. CASIT is currently managed by a team and the executive director is Dr. Erik Dutson. This facility is the location of many VR and AR research projects in addition to those I have mentioned above.	The biggest impediments to doing VR and AR research at UCLA is lack of funding for graduate.		VR and AR will become increasing important for the development of minimally invasive surgery and interventional procedures.
Song-Chun Zhu	No Response			
Sungtaek Ju	Using AR/VR for enhancing and facilitating hands-on lab and other courses for engineering and science fields	Lack of resources (hardware and software development) for those who can benefit from but do not directly work on the fields	Using AR/VR for enhancing and facilitating hands-on lab and other courses for engineering and science fields	

Name:	Do you have any brief thoughts to share with the task force about the most exciting near-term developments in VR and AR, broadly defined? We are especially interested in any areas where you believe UCLA could be well poised to excel.	Have you encountered any specific impediments or limitations to working in these areas that you think the task force should know about? If so, please briefly describe below.	If you do not currently work in VR/AR but you expect to in the future, or if your work has implications for VR/AR, please briefly describe below.	Is there any additional information you wish to share with the task force?
Laurent Pilon	Areas where UCLA could excel in VR/AR include entertainment, biomedical applications, engineering applications (e.g., aerospace) where environmental awareness is critical.	The limitations is to move in these research areas and find collaborators at UCLA to work/learn with.	I am interested in enhanced road visibility through AR for cars.	
Jason Cong	Customized hardware accelerators on FPGAs for AR	No		
Tzung	VR for micro-surgery planning and training			
Lei He	No Response			
Paul Eggert	Application of big data and machine-learning techniques to VR and AR is perhaps the most-exciting near-term area. Although UCLA could excel here, it'll need to hire.			
Francis F. Chen	No Response			

APPENDIX B: A Survey of Major University/Virtual/Augmented Reality Programs, Centers, Institutes, Labs and Projects.

The attached memo provides a summary of preliminary research conducted by the UCLA Law Library (as of 11/15/18). The memo identifies the institutes, centers, programs, departments, labs, and projects that focus on virtual or augmented reality at major U.S. universities. The memo includes a close look at the 33 top-ranked (by US News) national universities and picks out prominent centers at universities outside the top 33. It also includes selected recent articles that discuss virtual or augmented reality in higher education.

The goal of the memo is to provide an overview of existing VR/AR/XR work at peer institutions, based upon a review of available website information in order to provide the committee with a better understanding of the existing landscape and field. For this purpose, we did not gather more comprehensive information through outreach to, or interviews with, researchers or staff at these institutions.

Major University Virtual/Augmented Reality Programs, Centers, Institutes, Labs and Projects (11/15/18)

Centers and Programs at the Top 33 National Universities

Princeton

Virtual Reality for Arms Control, Nuclear Futures Laboratory – A project of the Nuclear Futures Laboratory, multidisciplinary initiative of the Department of Mechanical and Aerospace Engineering and the Woodrow Wilson School of Public and International Affairs, collaborating closely with Princeton's Program on Science and Global Security and with the International Panel on Fissile Materials. The project explores the potential of virtual environments to support innovations in nuclear arms control, in particular, the role they could play in developing facility architectures and verification protocols for treaties that do not yet exist.

StudioLab, Council on Science and Technology – A project of the Council of Science and Technology to bring together students, faculty, and staff, independent of area of concentration, to explore the intersections and shared creativity across STEM, the arts, humanities, and social sciences. The space features motion capture, virtual reality, theater lighting, sound system, dance flooring, robots, 3D printing, conductive fabric and sewing, laser cutting, CNC milling, electronics, computers, building, and more. Programmatic initiatives include courses, labs, studios, student projects, student-led and staff-led activities and workshops, open creative hours, and thematic "hackathons" on social justice topics.

Virtual Reality MATLAP Engine, Neuroscience Department – A MATLAB-based software package for designing and running virtual reality experiments on animals.

3D3A Lab – Founded in 2008 by Professor Edgar Choueiri with a research grant from the Shostack Foundation. Research encompasses such related topics as spatial hearing, auralization, 3D audio, binaural audio through speakers, crosstalk cancellation, and advanced hearing aids.

Harvard

AR/VR Studio –Harvard Innovation Labs - A resource for all full-time students that provides access to a studio of AR/VR technology and hosts workshops.

Augmented & Virtual Reality (AR/VR) - Harvard Graduate School of Design – A collaboration between Computer Resources, Media Services and the Loeb Library within the Graduate School of Design, this program allows Design students to borrow AR/VR Gear .

Virtual Reality – Chandra X-Ray Observatory - A three-dimensional virtual reality (VR) with augmented reality (AR) version of 3D data collected by NASA's Chandra X-Ray Observatory & Brown University.

Columbia

VR/AR Lab – launched in October 2018, a partnership with the NYC Media Lab, this lab will be the first publicly funded VR/AR lab. It will act as a hub for translational research and innovation, startups and job training.

Examining Racism with VR – interdisciplinary project between social workers and human computer interaction specialists to imagine the role VR could potentially play in expanding individuals understanding of racism.

MIT

VR/AR at MIT – A project supported by the Creative Arts program of the Martin Trust Center for MIT Entrepeneurship. Hosts a series of speakers, groups, and themes every Thursday, runs the Mobile Development Challenge (an MIT course founded in partnership with Google, culminating in an open-to-public expo with prizes), and a makerspace with VR-ready computers and HTC Vive equipment.

The MIT Media Lab has hosted many VR/AR events, such as a Hackathon, and is home to a number of research projects, which can be viewed here. In particular, their "antidisciplinary" Fluid Interfaces group focuses on virtual reality.

Play Labs – Launched in early 2017, an Accelerator for Students and Alumni focusing on virtual, augmented, and mixed reality.

Chicago

The Research Computing Center hosts courses and events relating to VR such as a hackathon (where some projects are demo'd at the MindBytes Symposium).

Yale

Blended Reality: Applied Research Project – partnership between Yale and HP to explore blended reality. Research teams for 2017-2018 included Blended Reality Artists Collective, Blended Reality as a Teaching Resource, and Immersive Tools for Learning Basic Anatomy.

Augmented Reality Project at School of Medicine and Nursing – collaboration between School of Medicine and Center for Collaborative Arts and Media to develop augmented reality visuals to teach human anatomy.

play4REAL Lab – a lab of the Center for Health & Learning Games, it hosts projects creating evidence-based learning and behavior change experiences through the use of VR and AR.

Reality of Global Change Hackathon – co-sponsored by several centers and groups at Yale, including the Center for Business and the Environment, Center for Collaborative Arts and Media, Data-Driven Yale, and Program on Climate Communication. The inaugural hackathon occurred in 2018 and showcased projects that visualize and gamify climate change data using virtual reality, augmented reality, and motion capture, among other tools.

Center for Collaborative Arts and Media, Blended Reality Program – hosts studios to use and develop "XR" (VR/AR), and hosts events, fellows, and courses related to VR/AR.

Stanford

Virtual Human Interaction Lab – with a mission to understand the dynamics and implications of interactions among people in VR simulations, the lab hosts research projects such as Social Interaction in Virtual Reality, and Examining Racism with Virtual Reality (collaboration with Dr.

Courtney Cogburn from Columbia University, discussed above). Many projects are available for download.

Neurosurgical Simulation and Virtual Reality Center – opened in 2016, uses patient-specific, 3-D virtual reality technology in neurosurgery clinics, the operating room, and the classroom.

Virtual Reality Immersive Technology Program – a program of the Department of Psychiatry and Behavioral Services, it is dedicated to studying VR/AR in mental and behavioral health settings across disciplines.

Incubator for Medical Mixed and Extended Reality at Stanford (IMMERS) – an initiative to enable medical applications of AR, particularly where patient data is projected onto the patient's body.

Duke

Office of Information Technology's page on Virtual and Augmented Reality – hosts or co-sponsors three locations on campus to develop and experience VR.

Duke Immersive Virtual Environment – virtual reality system dedicated to exploring techniques of immersion and interaction. Now open only for research. Projects include the Walk Again Project, which uses brain-machine interfaces that incorporate a virtual reality (VR) system that uses their brain activity to control their legs.

Duke Digital Initiative – hosts projects including VR, such as a project entitled ""Repurposing Virtual Reality Technology for Educational Use: Molecules in Action 3D"

Virtual Reality Treatment Program at the Duke Faculty Practice – offers a human-computer interaction form of therapy for individuals with anxiety disorders due to phobias.

Institute for Virtual and Augmented Reality for the Digital Humanities – two-week summer institute focused on the application of VR and AR to humanities research, teaching and outreach.

Virtual Reality in Archaeology – project to develop archaeological VR experience using data and 3D models from a site in Turkey.

Penn

Perelman School of Medicine Neurology VR Laboratory – multiple projects such as VR phantom limb pain therapy, 3D echocardiogram visualizers, and many more.

PennImmersive – a cross-campus VR/AR organization formed in cooperation with the Penn Libraries to explore the potential of VR/AR in teaching, research and learning. Library website here.

SIG Center for Computer Graphics – hosts VR/AR equipment among other technology.

Johns Hopkins

Digital Media Center – a multimedia lab space and resource for students interested in exploring emerging media and technology. Several projects listed on the projects page have a VR focus.

Digital Education & Learning Technology Acceleration (DELTA) Grants – Office of the Provost grant program to encourage digital education innovations with 5 awards of up to $75,000 each.

Northwestern University

Northwestern Feinberg School of Medicine's Virtual Reality Space offers a number of virtual reality simulators, including ultrasound, endobronchial robotic and ophthalmology simulators. Multiple departments across surgical and medical specialties at Northwestern rely on these cutting-edge educational tools to help train their residents in procedural tasks and operations.

Northwestern University's Knight Lab is a community of designers, developers, students, and educators working on experiments designed to push journalism into new spaces, including AR/VR projects.

Residents of the Garage have access to the AR/VR Lab, which provides access to the technology for the development of VR and AR software. The Lab also functions as a photography and videography studio. All students, faculty, and staff of Northwestern are welcome to visit for an AR/VR demo during staffed hours.

California Institute of Technology

Caltech Library now has a Virtual Reality Workstation that is available to the Caltech Community. The Workstation includes a HTC Vive goggles, 2 Vive controllers, and a computer with a Nvidia GeForce GTX 1070 graphics card

The Bruce Murray Laboratory for Planetary Visualization is a new facility within the Division of Geological and Planetary Sciences at the California Institute of Technology. The goal of the lab is to develop and implement state-of-the-art image processing, visualization and data integration techniques. The Murray Lab is actively engaged in terrestrial data visualization projects, including production and rendering of ultra-high-resolution gravity models, topographic models, and cm-scale drone imaging and topographic modeling of field sites.

Dartmouth College

Department of Computer Science offers an M.S. in CS with Concentration in Digital Arts, which includes a mix of computer science courses, digital arts courses, and research/thesis. They experience a rigorous and focused computer science education, foundational courses in digital arts, and a deep dive into a research topic within the areas of visual computing and digital arts (e.g., computer graphics, HCI, digital fabrication, digital art and media, computer vision, VR, and AR).

Digital Arts Leadership and Innovation lab (DALI) allows students to design & build mobile applications, websites, virtual & augmented reality, digital installations, and more.

Brown

Center for Computation & Visualization (CCV) is an environment where computational best practices, innovative solutions, and expert knowledge combine to build advanced tools for research and scholarship, and enable new discoveries and empowering collaborations.

YURT is CCV's state of the art virtual reality theater.

CAVE is CCV's original fully immersive display system.

Visualization Lab complements the Cave system and provides an area for experimenting with new technologies that relate to the CAVE/YURT as well as to broader areas of visualization technologies. These include head-mounted devices such as the Oculus Rift, 2x2 tiled video walls, ultraHD high resolution video, gestural systems such as Kinect, and related development software such as Unity, Blender, and others.

Vanderbilt

The Wond'ry is the epicenter for Innovation and Entrepreneurship at Vanderbilt University. Its three story, 13,000-square foot space, located adjacent to the new state-of-the-art Engineering and Science Building, facilitates transinstitutional collaboration between students and faculty from all schools, levels, and disciplines. From engineers to scientists to entrepreneurs to artists, the Wond'ry is the primary point of connection for students interested in innovation and entrepreneurship. The WOND'RY: AR/VR lab guides students and researchers through the possibilities of VR.

Cornell

Department of Design & Environmental Analysis' D.U.E.T. (Design for User Experience with Technology) Research Lab is devoted to the empirical and interdisciplinary study of emerging technology and design variables affecting the way people feel, think, and act in designed environments. Research areas of emphasis include virtual reality simulation for design and visual communication.

The Virtual Embodiment Lab in the Cornell Communication Department studies embodiment and presence in virtual environments.

Rice

Research in Augmented and Virtual Environments is a recently launched initiative in the Texas Medical Center (Rice/BCM) to explore the frontiers of mixed and mediated realities.

Notre Dame

University of Notre Dame's Wireless Institute collaborated with Nokia for augmented reality on mobile phone services.

Washington University, St. Louis

The Fossett Laboratory for Virtual Planetary Exploration is an innovative facility for teaching and research managed by the Department of Earth and Planetary Sciences. The Lab collects,

visualizes, and explores three-dimensional data from the atomic to the planetary scale using an AR platform. The Lab also supports some research and outreach activities within the Earth and Planetary Remote Sensing Laboratory, including use of virtual reality to help plan the Mars Curiosity rover paths.

Emory

Virtual + Augmented Reality: Digital Visualization Laboratory helps students and faculty members with interactive multidisciplinary-media design, educational gaming and various simulation and training activities.

Georgetown

The medical library provides a guide on uses of virtual reality in medicine and provides an assortment of augmented reality apps and virtual reality headsets to medical students.

Berkeley

The Center for Augmented Cognition supports Berkeley faculty and students in their research on new computing paradigms and methodologies of human cognition modeling, human-computer interaction, and human-robot collaboration through augmented and virtual reality technologies.

The AR/VR Design Experience track in the Visual Computing & Computer Graphics concentration creates a multi-disciplinary curriculum that offers students a comprehensive education and research experience in the emerging field of Augmented Reality and Virtual Reality.

Berkeley recently opened an AR/VR Lab for students and faculty.

USC

The Medical Virtual Reality (MedVR) group at the University of Southern California Institute for Creative Technologies is devoted to the study and advancement of uses of virtual reality (VR) simulation technology for clinical purposes. In diverse fields including psychology, medicine, neuroscience, and physical and occupational therapy, the ICT MedVR group explores and evaluates areas where VR can add value over traditional assessment and intervention approaches. Areas of specialization are in using VR for mental health therapy, motor and cognitive skills rehabilitation, assessment, and clinical skills training.

The USC Institute for Creative Technologies' Mixed Reality Lab (MxR) explores techniques and technologies to improve the fluency of human-computer interactions and create visceral synthetic experiences. MxR works with the Interactive Media Division at the School of Cinematic Arts. Research and prototypes focus on immersive systems for education and training simulations that incorporate both real and virtual elements. Projects push the boundaries of immersive experience design, through virtual reality and alternative controllers. The MedVR Lab and Graphics Lab at ICT are frequent collaborative partners.

The USC SensoriMotor Assessment and Rehabilitation Training in Virtual Reality Center (USC SMART-VR Center) is a multidisciplinary center that brings together world-class investigators across movement science, engineering, neuroscience, and rehabilitation to study and develop virtual reality interventions for neurorehabilitation.

The University of Southern California Norris Comprehensive Cancer Center has partnered with Springbok Cares to provide a unique Virtual Reality (VR) initiative for patients in the Adolescent and Young Adult (AYA) Cancer program at USC (AYA@USC). The patient initiative is designed to provide a library of curated cinematic and interactive VR experiences using the most advanced media technology available to lessen discomfort and anxiety with quality escapist entertainment.

Carnegie Mellon

CMU's Entertainment Technology Center has a number of virtual and augmented reality projects, including Project Voyage, which creates virtual classroom field trips, SocialVR, which is a virtual reality storytelling platform, MixAR, which explores the use of agents to help AR users work or play in their world, and Everywhere Music, which is an AR-assisted piano improvisation tool that allows users to perform live.

CMU has a Virtual Reality Museum to demonstrate the exciting potential that virtual reality and new photographic technologies hold for museums, including creating 3-D models of the Hall of Architecture through laser scanning. The Virtual Reality Museum is a project of the Hillman Photography Initiative's LIGHTIME.

Virginia

Their Viz Lab is a facility designed to help UVA faculty and students explore the power of visualization in research and education, and includes a virtual reality environment.

The Virtual Environments Studio is a place for students, faculty, and patrons to experience virtual reality in a relaxed setting without having any prior knowledge of the technology.

Their Medical Simulation Center features a number of virtual reality devices.

Tufts

The School of Engineering has a Scenario-Based Virtual Reality Testbed: The Natick Soldier Research, Development, and Engineering Center, with scientists and engineers at the Center for Applied Brain and Cognitive Sciences, are developing an urban, Scenario-Based Virtual Reality Testbed for objectively quantifying the impact of next-generation situation awareness technologies on Soldier and Small Team mission performance.

As of 12/7/2015, Tufts Medical Center announced that it enlisted local marketing firm Primacy to bring virtual reality (VR) to patient care. The technology will detail the pre-procedural process and show a 360-degree view of the medical facility and its staff, hopefully allaying patient fears before an appointment . . . As of now, Tufts will be the first medical center in the country to employ 360-degree virtual reality in a patient-care setting.

Michigan

UM3D Lab: As an interdisciplinary service facility, the UM3D Lab provides the entire University of Michigan community access to the tools, expertise, and collaborative opportunities needed to

support cutting-edge research, academic initiatives, and innovative uses of technology in the general areas of:

- Teaching and Learning
- Visualization and Simulation
- 3D Printing and Scanning
- Motion Capture
- Modeling, Animation, and Design
- Custom Tool and Application Development

MIDEN (Michigan Immersive Digital Experience Nexus): currently our most advanced audio-visual system for virtual reality. It provides its users with the convincing illusion of being fully immersed in a computer-generated three-dimensional world.

Wake Forest

N/A

NYU

Virtual Reality in Medical Education Certificate: designed to keep faculty informed of the latest advancements. We build VR experiences using higher-end devices like HTC VIVE to the more affordable Google Cardboard. We also offer a range of AR solutions by leveraging our Learner iPad program and experimenting with the Microsoft HoloLens. More info here.

VR/AR Lab: in June 2017, NYCEDC and the Mayor's Office announced plans to develop and operate a hub for virtual reality and augmented reality. The hub will leverage the leadership of NYC Media Lab and its founding university partners (NYU Tandon School of Engineering [the administering institution] and Columbia University) to manage and operate the space at the Brooklyn Navy Yard as well as a workforce development center at CUNY Lehman College in the Bronx. The VR/AR Lab will support new ventures with workspace and early-stage capital, make the industry more accessible through workforce development initiatives, and convene investors, university researchers, corporate leaders, and community organizations to collaborate with New York City's emerging VR/AR sector. More info here.

Mobile AR Lab: NYU's "Mobile Augmented Reality Lab" is a research group devoted to pioneering the field of mobile augmented reality with emerging AR technologies. The lab was founded by director Mark Skwarek, a full time faculty member at NYU's Integrated Digital Media Program.

UC – Santa Barbara

Four Eyes Lab: in the Department of Computer Science and the Media Arts and Technology Program at the University of California, Santa Barbara. Our research focus is on the "four I's" of Imaging, Interaction, and Innovative Interfaces.

AlloSphere: a three-story facility where we use multiple modalities to represent large and complex data, including immersive visualization, sonification, and interactivity. We are creating

technology that will enable experts to use their intuition and experience to examine and interact with complex data to identify patterns, suggest and test theories in an integrated loop of discovery. Important research areas include quantum information processing and structural materials discovery, bioengineering and biogenerative applications, and arts and entertainment. These content areas also drive media systems research in immersive display, computation, and interactivity. Our facility is differentiated from other virtual reality environments by both its seamless surround-view capabilities and its ability to accommodate large groups of researchers concurrently. Building the AlloSphere was not an off-the-shelf enterprise. Designing a large-scale environment to deliver rich, coherent, interactive, high-resolution 3D video and audio streams from massive scientific datasets is a complex computational and systems engineering task that continues to involve faculty across a variety of disciplines.

RE Touch Lab: we pursue fundamental and applied research on the future of interactive technologies, with emphasis on haptics, robotics, and electronics, including emerging opportunities in human-computer interaction, sensorimotor augmentation, soft robotics, and interaction in virtual reality.

U. North Carolina

Graphics & Virtual Reality Group: our research includes 3D scene acquisition & reconstruction, 3D tracking, fast rendering hardware and algorithms, autostereoscopic 3D displays, head-mounted and other near-eye displays, telepresence, and medical applications.

Consortium for Vision and Virtual Reality: The Consortium for Vision and Virtual Reality is a consortium bringing government and industry to partner with UNC in advancing research and technologies.

Virtual Reality Room: in the School of Information and Library Science, the VR Room allows users to immerse themselves in a virtual world of their choosing to experience a real life technology like no other. The VR room includes HTC Vive and Oculus Rift headsets, intuitive and natural touch controllers, and a wide variety of virtual environments.

AR/VR Interest Group: includes over 150 people from all across campus, including faculty, students, and staff from just about every department at UNC Chapel Hill, and then some. Our goal is to promote innovative teaching and learning, research, training, clinical care, and entrepreneurship through the use of immersive technologies.

UC – Irvine

Virtual Reality Club: a group of Virtual Reality enthusiasts dedicated to spreading VR awareness and developing VR projects

Transformative Play Lab: in the Dept. of Informatics, the TPL has a number of AR/VR events and pursues some AR/VR research. Research in the Transformative Play Lab is broadly interdisciplinary. We are concerned with questions of identity, justice, playfulness, design, and futurity. We ground our work in a combination of media studies methods (close reading of games and systems), design methods (creating research prototypes and speculative designs), and ethnographic methods (studying communities of practice).

U. Rochester

Del Monte Institute for Neuroscience's Center for Augmented and Virtual Reality: To fully understand the brain, we must study how it functions under naturalistic conditions. The rapid recent maturation of augmented and virtual reality (AR/VR) technology promises unprecedented opportunities to accomplish this goal. Over the past few years, multi-billion dollar AR/VR investments by Google, Facebook, Apple, and other companies, have produced wearable, inexpensive and truly immersive technology that is certain to continue to improve and eventually become ubiquitous. The realism and immersiveness afforded by VR and related technology enables the development of much more realistic, multisensory environments that will allow basic scientists to study, at an unprecedented level of detail and sophistication, how information from different senses is integrated with motor and proprioceptive signals. This will enable us to understand how we perceive and engage with the 3D visual and acoustic structure of the environment, navigate through that environment, and make value-based decisions in realistic situations.

The Del Monte Institute also has a Cognitive Neurophysiology Lab that has built MoBi, the Moible Brain/Body Imaging system. It is a powerful new state-of-the-art tool to study diseases like Autism, Alzheimer's, and traumatic brain injury. The MoBI platform combines virtual reality, brain monitoring, and Hollywood-inspired motion capture technology, enabling researchers to study the movement difficulties that often accompany neurological disorders and why our brains sometimes struggle while multitasking.

There are a number of collaborations dealing with AR/VR technology. For example, a collaboration between the schools of Music and Engineering uses recital halls as their "labs," to create virtual reality videos of concerts that literally immerse viewers "within" the performance onstage. There is also a virtual reality app being created to offer cognitive-behavioral therapy through funding from Arts, Sciences & Engineering and the Medical Center.

Hands-on learning and research lab at the Science and Engineering Library: will give students and faculty a place to explore augmented and virtual reality—regardless of their level of expertise. The timeline for actual construction will depend on how soon funding can be secured. AR/VR research is one of the University's top research priorities.

Intersections: this page highlights cross-disciplinary approaches to teaching, learning, and research, including AR/VR projects.

Prominent AR/VR Centers at Schools Outside the Top 33

Iowa State

Iowa State University's Virtual Reality Applications Center (VRAC) is an interdisciplinary research center focused at the intersection of humans and technology, aimed broadly at enhancing the productivity and creativity of people. The VRAC's world-class research infrastructure supports the research of faculty and students representing all seven of ISU's colleges, as well as the interests of collaborators from several federal agencies and numerous industry partners.

Washington

The UW Reality Lab brings together an interdisciplinary team of UW faculty, graduate students, and undergraduates working in 3D computer vision and perception, object recognition, graphics, game science and education, distributed computing, stream processing, databases and computer architecture, and privacy and security. The UW announced the Reality Lab in January 2018 (press release).

The Human Interface Technology Lab (HITLab) is a multi-disciplinary research and development lab involving engineering, medicine, education, social sciences, architecture, and design arts. Most, if not all, of HITLab's research projects involve virtual and augmented reality. HITLab seems to be a partnership between the University of Washington, the University of Tasmania in Australia, the University of Canterbury in New Zealand, and others.

CoMotion Labs hosts startups in a number of tech disciplines including AR/VR. CoMotion Labs @ HQ opened in 2016 and is dedicated to augmented and virtual reality industries. 20 startups are hosted there. It has 34 desks, 3 conference rooms, 2 mixed reality labs, event space for 150+, and a kitchen.

The Human Photonics Laboratory (HPL) works to advance optical technology in the areas of human performance, cancer detection and treatment. HPL has ties with HITLab. HPL's research involves virtual reality, 3D optical projection, and other visual technologies.

The Translational Research and Information Lab (TRAIL) includes virtual reality equipment to support medical software development and research.

The Information School has initiated a study on VR and libraries.

Kansas

The Institute for the Exploration of Virtual Realities is an institute within the University Theatre and the Department of Theatre at the University of Kansas whose goal is to explore the uses of virtual reality and related technologies and how they may be applied to theatre production and performance.

Minnesota

Their Virtual Reality Design Lab is a partnership between the College of Design and Computer Science and Engineering. Their current research is focused on making virtual reality a social experience.

Pittsburgh

The Medical Virtual Reality Center (MVRC) is part of the Raymond E. Jordan Center for Balance Disorders, based in the Department of Otolaryngology (Ear, Nose and Throat) in the University of Pittsburgh School of Medicine and University of Pittsburgh Medical Center. The goal of the MVRC is to use virtual reality to examine basic underlying factors contributing to postural control in persons with and without balance dysfunction and to explore new ways of treating balance disorders.

Drexel

Drexel's College of Media Arts & Design has a Virtual Reality (VR) & Immersive Media degree program that equips students with the technical and creative skills needed for the cutting-edge field of immersive media.

Chapman

Dodge College of Film and Media Arts also has a new addition to its academic offerings—a new minor in Virtual Reality and Augmented Reality (VR and AR). Students will explore the uses of immersive media for storytelling across a wide range of fields as part of their curriculum. Classes will look at the history and development of the new medium and students will learn how to plan and strategize in creating immersive media projects. Faculty in Dodge's Institute for Creative Reality (ICR) developed the minor in consultation with industry experts, particularly Roy Taylor, corporate vice president of AMD/Radeon Technologies, a company that develops high-speed graphics processing units (GPUs) for use in virtual reality and video game creation. Additional funding used to kick-start and sustain the Institute of Creative Reality is provided by proud parent Srini Srinivasan.

Georgia Tech

The Interactive Media Technology Center (IMTC) was founded in 1989 to create multimedia tours of Atlanta in its push to host the Olympics. It continues as an interdisciplinary lab to promote research on a number of topics, including augmented reality.

The GVU Center promotes interdisciplinary research regarding technology and society. It has a number of areas of research, including both augmented reality and virtual reality. It also operates an Augmented Environments Laboratory.

Michigan State University

The College of Communication Arts and Sciences hosts a number of centers and labs, many of which include research regarding virtual and augmented reality, including:

The Center for Avatar Research and Immersive Social Media Applications (CARISMA) Lab opened in October 2016 to draw upon interdisciplinary research to refine and develop virtual reality technology for use in a number of areas such as education, training, therapy and rehabilitation, and e-commerce.

The Theoretical and Applied Research on Media Affect and Cognition (TARMAC) Lab to promote research in the area of media psychology. Current projects include work on virtual reality.

The Games for Entertainment and Learning Lab's projects includes ones with virtual reality components.

The MSU Libraries operates a Digital Scholarship Lab, and that Lab includes a Virtual Reality Room. Also of interest is that the Digital Scholarship Lab hosted an event last spring where interior design students used virtual reality in making presentations to the Michigan Department of Natural Resources with plans to revitalize historic buildings in Detroit.

The Institute of Cyber-Enabled Research provided support for a project into how motor skills can be learned through virtual reality.

Rochester Institute of Technology

The Media, Arts, Games, Interaction and Creativity (MAGIC) Center opened this fall. It is a 52,000 square foot research center and production studio devoted to digital media, and it includes virtual reality facilities.

The CS Graphics and Applied Perception Lab is operated by the Computer Science department to promote research regarding computer graphics, eye tracking and virtual reality. The Lab provides interdisciplinary and cross-college collaboration opportunities.

The Multidisciplinary Vision Research Lab aims to further the understanding of high-level visual perception. While the Lab's public facing website does not include many details on their work, it seems likely that the work includes augmented and virtual reality.

RIT hosts the National Technical Institute for the Deaf (RIT/NTID). RIT/NTID recently received a grant from the National Science Foundation to explore how to use augmented reality to make stem content more accessible to deaf and hard-of-hearing learners.

University of Illinois at Chicago

The Electronic Visualization Laboratory was founded in 1973 in collaboration with the College of Engineering and the School of Art and Design to further research into high-performance, visualization, virtual reality, and collaboration systems.

The CoNECt lab is an interdisciplinary lab for the study of brain connectivity. Their current projects include one specific to virtual reality, and there may be other projects involving virtual or augmented reality.

Selected Recent Publications

- Greg Brening, Future or Fad? Virtual Reality in Medical Education, AAMC News (Aug. 28, 2018)
  Discussing virtual and augmented reality in medical education and quoting faculty from UC Irvine and Stanford medical schools.
- Beth McMurtrie, Not Just for Video Games: Virtual Reality Joins the Classroom, The Chronicle of Higher Education (June 21, 2018)
  Identifying a workshop at Yale where representatives from 12+ colleges discussed their experiments with VR, AR, and 3D printers, including:
    - Case Western Reserve (building 3D visualization in its health education campus)
    - Syracuse University (journalism students using VR in storytelling)
    - Hamilton College (using 3D tools to prepare orchestra conductors)
    - Florida International University (first-year students use VR on a community project)
    - Yale (encourages faculty members to explore immersive reality in teaching)
- Amy Burroughs, UBTech 2018: Higher Ed Sees Great Potential in Virtual Reality, EdTech Magazine (June 7, 2018)
  Referencing a survey showing that 55% of colleges have a dedicated VR space, 51% have a movable or ad hoc space, 38% let users check out VR equipment, and 26% use a mobile cart and noting that one of the biggest challenges to VR implementation is wifi network capacity.
- 3 Uses of Virtual Reality on Campus, EAB.com Daily Briefing (May 31, 2018)
    - Identifying current uses of VR at:
        - Western University of Health Science (anatomy students using a virtual dissection table)
        - Hastings College (VR to practice public speaking)
        - Lehigh University (Center for Innovation in Teaching and Learning trains students and faculty to use VR tools)
        - Chapman University (developing major specific to the AR/VR industry)
        - University of Washington (development major specific to the AR/VR industry)
        - Fox Valley Technical College (VR to expose students to the work of electricians and HVAC techs.)
        - Savannah College of Art and Design (provides VR headsets to accepted students to let them virtually explore the campus)
- Mark Billinghurst, Where in the World is AR Research Happening, Medium (May 21, 2018)
  Identifying the leading AR researchers by country and university; in the U.S. these leading researchers include Steve Feiner (Columbia), Blair MacIntyre (Georgia Tech.), Bend Girod (Stanford), Ramesh Raskar (MIT), and Hideaki Ishii (MIT).
- Six Ways Augmented Reality is Making its Mark on College Campuses, Epson Blog (May 10, 2018)
  Noting that, by 2025, $700 million will be invested in AR/VR technology for the educational market, and identifying certain current uses of AR at:
    - Case Western Reserve (in anatomy classes)
    - Leeds College of Music (to teach recording technology)
    - University of Wisconsin – Madison (the Field Day Lab developed an AR "situated documentary" allowing visitors to experience a 1967 campus Vietnam protest)
    - Oklahoma State University (hosted a Virtual + Augmented Reality Hackathon)

    - Western Michigan University (AR Sandbox for earth science students)
    - Cal Poly Pomona (AR incorporated into campus tours)
- Erin Brereton, 4 Ways Colleges are Embracing Virtual Reality, EdTech Magazine (May 9, 2018) – Noting that, by 2021, 60% of universities will be using VR to create simulations and immersive learning environments and identifying certain current uses of VR at:
    - Western University of Health Sciences (virtual reality learning center includes a virtual dissection table),
    - Eastern Michigan University (AR sandbox for use in earth science class),
    - Lehigh University (teaching VR at the Center for Innovation in Teaching and Learning),
    - Chapman University (developing relevant majors, courses, and research labs),
    - University of Washington (developing relevant majors, courses, and research labs), and
    - Savannah College of Art and Design (sending VR headsets to accepted students to let them take virtual school tours and incorporating AR into their videos shared with prospective students).
- Bridget M. Kuehn, Virtual and Augmented Reality Put a Twist on Medical Education, JAMA Network (Feb. 27, 2018)
  Discussing virtual reality applications for medical education at:
    - University of Southern California (article quotes the Associate Director for Medical Virtual Reality at the Institute for Creative Technologies)
    - Bond University in Queensland, Australia (use of a specialty AR/VR device for anatomy education)
    - Case Western University (development of interactive holograms)
- Sarah Howard, Kevin Serpanchy & Kim Lewin, Virtual Reality Content for Higher Education Curriculum, VALA Proceedings (Feb. 13-15, 2018)
  Reporting on a joint research project between the Queensland University of Technology Library and ProQuest to provide virtual reality content and resources to students and staff.
- Recent Private Gifts to Higher Education, The Chronicle of Higher Education (Feb. 11, 2018)
  Reports on a $15 million gift to the Ringling College of Art and Design for a new endowed chair in virtual reality, along with scholarship support, capital improvement, equipment, and the college's new Sarasota Museum of Art.

APPENDIX C: VR TASK FORCE MINI SYMPOSIUM, OCTOBER 22, 2018 AGENDA

Each presenter was given 10 to 15 minutes to present highlights on his or her research and asked to assess what might be the strongest possible directions for a VR/AR Institute at UCLA. Each presentation was followed by Q&A with the Task Force members.

- **Erik Dutson, MD, FACS**
  Clinical Professor, UCLA Department of General Surgery
- **Jeff Burke**
  Professor-in-Residence, UCLA School of Theater, Film & Television; Associate Dean, UCLA Technology & Innovation
- **Alesha Unpingco**
  UX Lead, VR/AR Partnerships, Google
- **Steven Anderson**
  Associate Professor, UCLA Film, Television & Digital Media
- **Nanthia Suthana**
  Assistant Professor-in-Residence, UCLA Department of Neurosurgery
- **Mayank Mehta**
  Professor, UCLA Department of Physics & Astronomy
- **Eugene Volokh**
  Professor, UCLA School of Law
- **Rebecca Allen**
  Professor & Chair, UCLA Design, Media Arts