# The CDLG

## Inspiration

Our own experiences with silo-free, hyper-creative environments as well as a close study of places like Bell Labs, Xerox PARC, Rad Labs in Boston during WWII, and Los Alamos National Laboratory form the inspiration for the Complexity, Data, and Learning Group (CDLG). The deep need for such an experiment at most land grant schools, including Washington State University (WSU), adds further impetus. Adding our deep interest in public grounding, and our interest in setting new standards for disciplinary integration and instinctive intelligence, brings us to the design for the new group. ([2–5])

## Foundational Principles and Design for the CDLG

- Silo free with sensible metrics: The CDLG is not constrained by traditional institutional structure. Interdisciplinary research is encouraged and appropriately rewarded using broad metrics for impact beyond just publication and funding records.
- Collision-rich environment for innovation and collaboration.
- Honest outreach: Immersive education for everyone.
- Agile culture: Agile software culture applied to research and education for rapid exploration of ideas, and triage to identify problems with the most impact. Productive ideas given time to mature with time to think to develop deep insight.
- Culture code: Safety/belonging enabled risk taking, vulnerability/generosity enabled rapid feedback, environment rich with vision reinforcing signals.
- Team leadership: Flat leadership structures encourage shared ownership, with organic project organization as needed.
- Thick data: Big data used for rapid analyses, but informed with thick data to produce deep and lasting results.
- Data privacy and ethical use of technology taken seriously.

*See Honest Outreach whitepaper. Agile/minimal viable product (MVP)/Hackathons.*

Getting the culture right with a closed-loop, feedback-control type design, we do not have to explicitly anticipate all the challenges in

the design of the CDLG. The culture itself is designed to self-correct, adapt and respond with agility, energy, and creativity.

## Core Content Focus

The content focus is included in the name:

- COMPLEXITY: Many of the most important problems facing us are hard because the real world is complex. Solving these problems requires broad and deep skills: nonlinear dynamics, multi-scale phenomena – both spatial and temporal, network structure, random/stochastic behavior, and high dimensionality.
- DATA: Big-data is a hot topic, but the massive flows of data currently fuelling surveillance capitalism are often biased and incomplete. Solving real-world problems with human insight requires understanding the nuance in scientific data. Thick data is needed to illuminate big data, allowing us to understand implicit prior assumptions that bias our inferences. Collecting thick data requires more human effort and resources, but is necessary for a fully human future.
- LEARNING: We interpret **learning** broadly, including *machine learning*, *statistical learning theory*, *how people learn*, and *environments for learning and change*.

Complex *is not the same as* complicated. *A watch can be* ***complicated****, but has predictable behavior. In contrast, weather is* ***complex****: prediction requires sophisticated models and is often only approximately valid.*

The focus of the CDLG is truly interdisciplinary. After jettisoning narrow views that sometimes develop in silos, it is hard to imagine a discipline that would not fit into and benefit from this framework.

## Initial Projects: Some Specific Tasks

The design of the CDLG removes friction from the process of creative exploration and discovery, while retaining the wisdom and reflection needed to establish deep results. This environment will produce a steady flow of new projects, starting with the following three, which are each described in their own whitepaper:

### Honest Outreach: Immersive Environments for Instinctive Mastery.

This project aims to create a highly effective and immersive environment bringing deep mathematical and physical insight to grade school and high school students. The intent is to create rich opportunities for

both faculty and students by providing useful and *instinctive mastery* of these subjects. This will significantly increase the size of the population that supports the work of mathematicians and physicists, while enabling students to become involved in technical work as a career.

### Mesoscale Urban Dynamics: where urban physics and human story meet

This project studies the effects of decisions and design (including metrics and policy) on the growth and development of "bridge towns" – communities with intermediate populations between small towns and large urban centers. Inspired by the urban scaling studies [1], we hypothesize that investment in bridge towns may have maximum impact on urban improvement. To fully understand this requires augmenting urban scaling data with thick social data, making this a complex interdisciplinary problem with significant impact both in the Palouse and throughout the world.

### Organizational Project: The Integrated Science and Mathematics (iSciMath)

We are extremely well positioned to create a research-focused education project at WSU: a collision-rich, silo-free, collaborative environment for innovation in those areas with a shared interest in modern mathematical tools. Many top researchers and scholars are adversely affected by isolation and low levels of cross-fertilization – environment is a very big deal. It is also the case that the interfaces between the narrow academic disciplines are extremely rich with new ideas and open questions. To explore these effectively, we need a diverse group that works together and speaks a common "language". The resulting atmosphere will enable us to recruit and retain the best faculty and students, addressing the significant recruitment and retention challenge at WSU. While important, solving the recruitment and retention challenge barely scratches the surface of this project's potential impact.

*These areas include mathematics, statistics, physics, economics, electrical engineering, computer science, and chemistry.*

## CDLG Activities

The CDLG will be supported by:

- SILO-BURSTING EXPERIENCES: Educational experiences designed to help faculty, students, and interested public, learn to connect across

traditional silo boundaries. Designed based on demand, these experiences will provide the core "language" needed to effectively launch interdisciplinary projects at the interfaces between disciplines.

- VISITORS/WORKSHOPS/SUMMER SCHOOLS: Visiting scholars, intense workshop, and summer school programs will bring in experts and recruit talent.
- PROJECTS ACROSS SILOS AND TRIPLE POINTS: We will constantly explore rich triple junctions (for example, sociology/mathematics/-physics or economics/physics/sociology), in agile/MVP/Hackathon style jam-sessions looking for new projects with deep potential.
- PUBLIC IMMERSIVE EXPERIENCES: We will be heavily invested in communicating our core research to everyone from grade school children to adults using highly visual, but accurate analogies. This has many important benefits to everyone involved as described in the corresponding whitepaper.

# Bibliography


[1] Luís M. A. Bettencourt. The origins of scaling in cities. *Science*, 340(6139):1438–1441, 2013.

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[4] Daniel Coyle. *The culture code: The secrets of highly successful groups*. Bantam, 2018.

[5] Michael A. Hiltzik. *Dealers of lightning: Xerox PARC and the dawn of the computer age*. Harper Business, 2000.