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Citizen Science Study Design

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July 9, 2015

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Questions to Consider when Designing a Citizen Science Study

- Why am I doing this?
- How am I going to do this?
- What type of useful and valid data do I need to collect or use?
- Where should I collect my data?
- What resources (equipment, people, money) do I need to do this?
- What will I do with this information?

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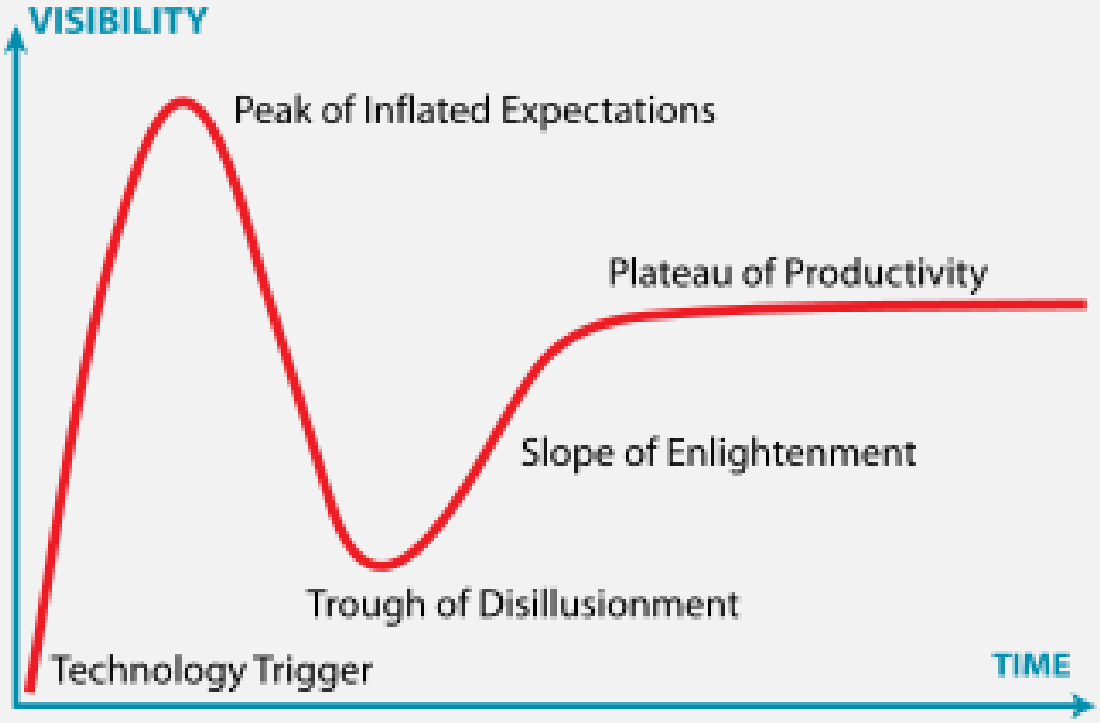
Why am I doing this?

- What is my motivation?
- What question am I looking to answer?
- What is my **goal**?
- Am I the only one who wants to do this or are there similar projects or organizations already doing this?
- Can I do it? Alone or in collaboration? Do I have a team? Do I have money?

Let's talk about your goal or goals…

My Goal or Goals

When designing a project with a goal or goals in mind, consider something called the **Gartner Hype Cycle**



Source: http://en.wikipedia.org/wiki/Hype_cycle

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My Goal or Goals

- It is a crucial element of your work
- The success of your work depends on it
- You have to agree to the goal or goals you choose
- Your goal should be something **tangible** and **quantifiable**, **clear** and **well articulated**
  - A good example: a source tracking study of pathogens to identify contamination and keep your beaches open.
  - A not so good example: to raise the awareness of health issues in your community.
  - A very bad example: monitoring a few spots in your neighborhood -OR- counting birds in the County Park.

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My Goal or Goals
The Road To Success

So, WHAT do you do NOW?

You **BRAINSTORM** with your **TEAM**!

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Potential Brainstorming Questions

- What are the questions you have?
- Are you doing things because they are needed or because you can?
- Does your project or study make sense?
- How will it answer your basic question or questions?
- Does the progression of your study lead you from ***awareness to recognition to action***?

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The Outcome?

We have a…

GOOOOOOAL!!!

Are We Ready for the Study Design?

Yes, we are!

We have…

- ✓ One or more goals
- ✓ A project team
- ✓ Participants and/or collaborators
- ✓ Funding and Resources

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PROJECT/STUDY DESIGN

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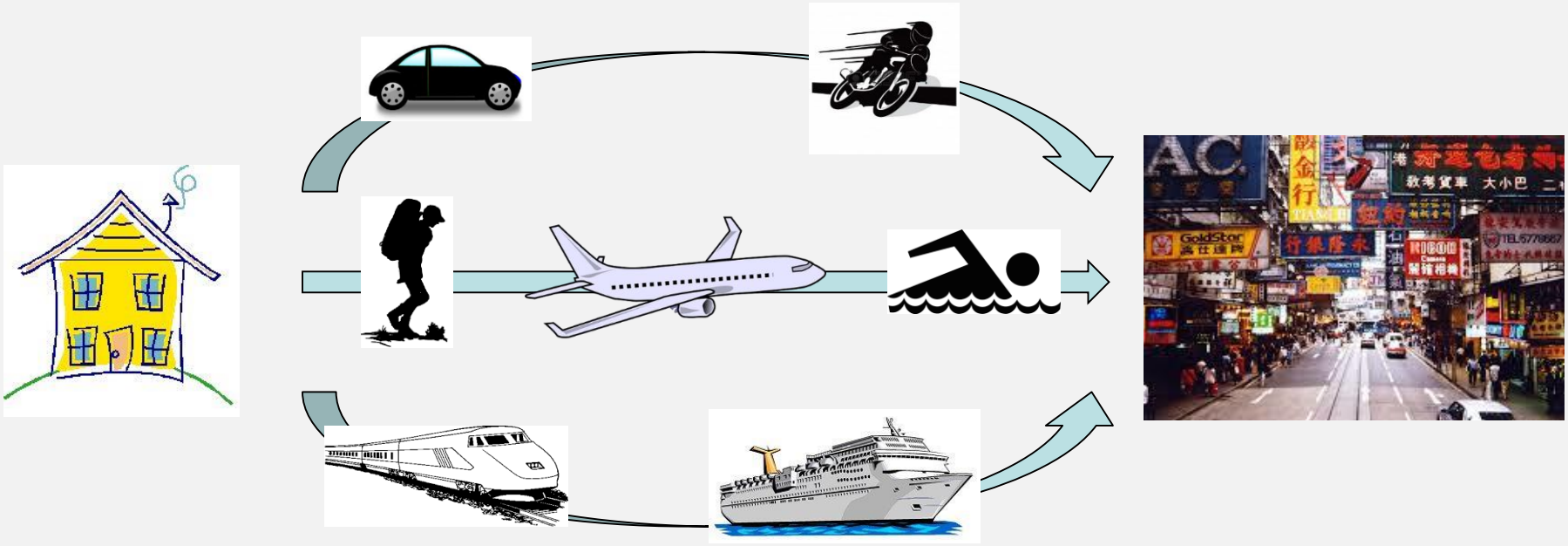
A Hypothetical Study and Its Design

Many possibilities



Which way will you choose to get to Hong Kong?
What will dictate your choice?
Do you have more than one choice?

Is your head spinning yet?

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Basic Elements of Study Design

- Study/survey protocol development
  - Location, frequency, equipment, methodology
  - Quantity of data
  - Quality of data
- Selecting and recruiting citizen scientists
- Technology requirements and use (web, computational resources and capacity)
- Supporting materials and mechanisms (e.g. central site, labs)
- Plans for analyzing data, results and information
- Project/study evaluation
- Lessons learned and next steps

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Study/Project Protocol Development

Location, frequency, equipment, methodology

- Location is key!
- A lot depends on WHERE you pick your sites
  - Are they the right sites to help you achieve your goal?
  - Is it safe to get to them and to sample?
  - Additional security measures needed to protect equipment?
  - How far are they from a lab or your location?
  - Are there a sufficient number of sites in the plan?
- Can I start smaller and build?
- How often will samples need to be collected and under what conditions?
- Do I have or can I get the equipment I need?
- Do I know or can I learn and teach the necessary methods to my team?

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Study/Project Protocol Development

Quantity and Quality of Data

- **Quantity of data**
  - Are we collecting discrete or continuous data, or both?
  - Are we using only our new data or are we adding someone else's data into the mix?
  - Based on the time line of my project, how much data will I have?
  - Will it be enough or do we need more?
- **Quality of data**
  - Understand the quality of data (Are your methods, equipments and/or lab giving you what you need?)
  - Do you have/are you ready to develop a criteria for accepting data?
  - Are you training your volunteers to provide what you need?
  - Do you know how to verify, evaluate and validate the data?

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Quantity and Quality of Data

A few more considerations

- Data complexity level vs. number of active participants and their level of understanding/training
- Are you integrating data over time, space or in a geospatial continuum?
- Are you collecting data for modeling or other purposes? Who will be using your data?
- Big data = 4V
  - Volume
  - Velocity (frequency)
  - Veracity (true reliability)
  - Variety (environmental, weather, water, air, data systems, etc.)

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Study/Project Protocol Development

Selecting and Recruiting Citizen Scientists

You need citizens in order to conduct a citizen science study!

- Who will be involved or available to help collect the data? (Specific age groups? Vulnerable populations? Anyone?)
  - This may depend on the goal of your study
- How will you go about recruiting citizen scientists?
  - Local citizen groups?
  - Community centers?
  - Social Media?
  - School administration?
  - Local/state environmental agencies?

Tip: If feasible, it's good to include citizen scientists in the planning stages

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Study/Project Protocol Development

Technology Requirements and Use

- **Equipment**
  - The type of equipment you use will directly tie into the handling of your data, your training, your costs, etc.
- **Web services**
  - Do you have forums to serve as a focal point for your project? Do you need to add on or create a brand new one?
- **Computational resources**
  - Will you use apps, uploads via smartphone, social media, classic data entry or a combination?
  - Do you have the data entry and all aspects of data management, such as statistical help covered?
- **Capacity**
  - Do you have the computer know-how, power, and the data storage you need for this project?

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Study/Project Protocol Development

Supporting Materials and Mechanisms

- **Supporting Materials**
  - Do you plan to have a central location or space from which you will manage all aspects of the project?
  - What are your chain of command and accountability measures?
  - How will you provide technical support if citizens have questions or need help troubleshooting problems? Dedicated support staff?
  - Do you have training materials, field procedures, and safety ready? Mentoring of newbies?

  Helpful Tip: Use existing materials if possible – don't reinvent the wheel unless you have to do it!
- **Laboratory, statistics, dissemination**
  - Is your lab the right one for your project?
  - Get the right statistical support!
  - Mechanism for communicating intermediate and final results?

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Study/Project Protocol Development

Plans for Analyzing Data, Results, and Information

- Accepting data
- Data entry
- Data management
- Data evaluation and validation
- Data reconciliation with your goals
- Data use and sharing
- Results – presentation and use of best media
- ***Disseminating and promoting your project start to finish – make that planning phase to finish!***

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Study/Project Protocol Development

Project/study evaluation, lessons learned and next steps

Project/Study Evaluation

- Your Project should be evaluated throughout its useful life
  - Baseline: prior to start, yardstick for measuring change
  - Formative: during the project, strengthen and improve effectiveness
  - Summative: at the end of the project or when you reach a decision point

Lessons Learned and Next Steps

- Assemble your team as many times as you need and have a session on meeting your goals, roadblocks, what to do the same or different and why
- Share your experience and invite outside feedback

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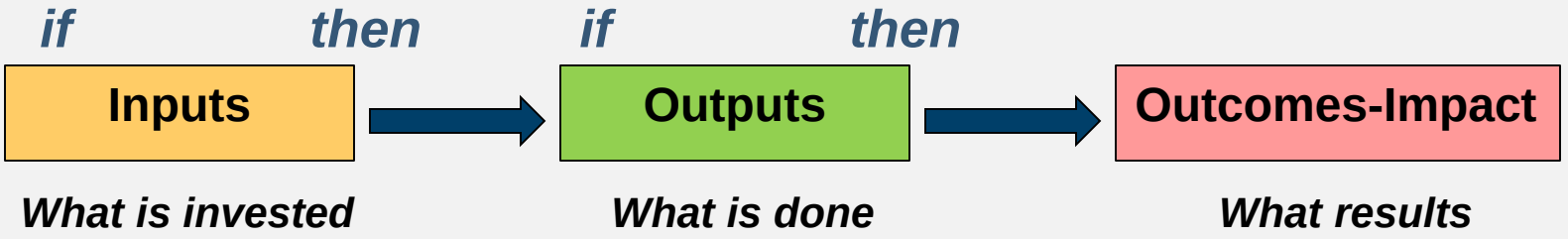
PROJECT/STUDY DESIGN – But HOW do I do it?

Outcome Mapping
Logic Model

The Logic Model and Study Design

In its simplest form a Logic Model is:



Key Terms:

Output: Activity or effort produced or provided

Outcome: Result, effect, consequence or impact

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All of the Elements

Resources	Activities	Outputs	Audience	Short-Term Outcomes	Intermediate Outcomes	Long-Term Outcomes
What we invest • Time • Money • Partners • Equipment • Facilities (lab)	What we do • Plan • Train • Monitor sites • Analyze, interpret data	What we produce or deliver • Workshops • Baseline data on local environment • Reports, publications, events	Whom we reach • Volunteers • Board of Directors • Sponsors • Partners • Public • Decision-makers	Change in: • Knowledge • Skills • Attitude • Awareness • Motivation	Change in: • Behaviors • Practices • Procedures	Change in: These are the impacts of the project • Environment • Social conditions • Economic conditions • Policies

Adapted from Michelle Mandolia, EPA Office of Policy, Evaluation Support Division

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A few other considerations….

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Test Your Study/Project Design

- Do a dry run from A to Z **BEFORE** you go live if you can
- Ground truth your sites if you are selecting new or unknown locations
  - Consider alternate sites if not safe or problematic in other ways
- Run through your training, field, lab and data management procedures
- Determine how long it will take to collect a sample or data point
- Do a mock informational session with results and information if you can
- **DON'T BE AFRAID TO CHANGE ANYTHING THAT DOESN'T WORK**

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Have a Backup Plan

Murphy's Law…

Anything that can go wrong, will go wrong

- A number of things could go wrong with a study…
  - Citizen scientists can drop out of a study
  - Data quality could be compromised
  - Sampling and analytical equipment can fail or get damaged
  - Data loss
  - Other unforeseen circumstances
- Always good to have an alternative plan for the "what-ifs"

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Resources

- Ask for help and be brave – your local college/university or big cooperation may have the math department, computers or lab that you need. A new friendship may be born.
- Collaborate – it's easier than going it alone
- Resources and materials on the web. For example…
  - ✓ EPA's Air Sensor Tool Box for Citizen Scientists http://www.epa.gov/heasd/airsensortoolbox/index.html
  - ✓ EPA Region 2 Citizen Science Page http://www.epa.gov/citizenscience/
- Work with your State, County, local officials and schools – nurture the next generation of Citizen Scientists

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A Thought to Take Home With You

Providing information is not enough to lead to better decisions. A two-way dialogue is necessary to collectively determine what type and information is needed to improve the knowledge of decision makers.

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Thank you!

Questions?

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