Reconstituting Community:
Varieties of Social Capital in Disaster Recovery.

Community Recovery in Greater New Orleans since Hurricane Katrina:
Social and Organizational Surveys, combined with
Engineering Assessments, Public Health Evaluation, and GIS Mapping

A Research Proposal submitted to
The National Science Foundation

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PROJECT SUMMARY (in NSF format)

Eighty percent of New Orleans was flooded in the aftermath of Hurricane Katrina in 2005; and recovery from the damage and disruption has been an enormous task. The recovery rests on three legs: (1) the degree of physical destruction (negatively), (2) the material and economic resources that people can bring to reconstruction, and (3) the contributions of social networks, community organizations, and leaders. Building on the research team members' recent work on the causes, impact, and aftermath of Hurricane Katrina, our research combines engineers' assessments of physical damage and repair, with geographers' spatial perspective, and with social science assessments of social factors. While government, insurance, and other large businesses provide many of the resources for physical reconstruction, people's well-being and their decision to return and rebuild are heavily influenced by social factors. We especially focus on the contribution of the nonprofit sector – faith-based organizations, neighborhood associations, community or relief organizations, and others. We attempt to isolate the importance of specific actions and strategies, and thereby identify a number of best practices that social actors can and have adopted. Building on intellectual traditions that go back to theories of civil society, culminating in Tocqueville's descriptions of the workings of democracy and community, we draw on recent work on social capital and political participation to explain how different communities have attempted to recover. We conduct three waves of individual-level social surveys of Greater New Orleans residents who have, or have not, returned. These surveys are conducted partly through organizations of which respondents are members, congregants, or clients. For each survey wave, engineering teams assess the damage and recovery of respondents' residences and surrounding neighborhoods. We also survey leaders of the organizations to which respondents belong. We enter all these data, and other geographical and spatial characteristics into a Geographic Information System (GIS). We assess three aspects of disaster recovery, (a) the material, (b) the emotional and

spiritual, and (c) the community elements. Our approach is multi-disciplinary and multi-level, integrating multiple elements at all points. We attempt to knit together disparate fields of social, geographical, and engineering sciences in a unified approach that we believe will yield fruitful insights and methods for further research.

This research has the potential of informing social, geographical, and engineering sciences of the benefits of collaborating on appropriate research projects. The insights gained from this research will help each field see how to approach elements that it has often found difficult to address. The research will also help train and educate junior faculty, instructors, graduate students, and undergraduates who participate, and thus increase scientific capacity. Most importantly, the research will be valuable to policy makers, community leaders, and community members in learning about and applying best practices for protecting communities from disasters and helping them recover. (We believe that there will not be a single set of "best practices" that apply to all communities, but rather, that different communities may have different successful strategies.) The research team is working closely with government, civic, and community leaders, service providers, and community members, and believes that researchers and practitioners each learn a great deal from each other and greatly help each other in their respective goals and tasks. Such partnerships help break down barriers between "experts" and "lay-people" and help spread scientific knowledge – and also help scientists more fully understand and appreciate relevant lay knowledge and expertise.

PROJECT DESCRIPTION

RESEARCH OBJECTIVES

This research tries to provide an evaluation of Greater New Orleans' recovery from Hurricane Katrina, from the perspectives of the residents and their communities. It attempts to look beyond basic population, damage, and economic numbers and find out what people's intentions are to stay or leave, their reasons, what they have gone through, how they feel about it emotionally and spiritually, whom they praise or blame – and to relate these subjective factors with the process of physical recovery. Perhaps most importantly, the research also investigates what community strategies and actions have been most effective in promoting recovery.

At present writing, a year and a half after the event, leading experts' assessments of the pace of recovery vary, from the conclusion that "the recovery effort is only inching along" (GNOCDC and Brookings 2007) to the optimistic assertion that New Orleans is well ahead of the pace set by previous disaster recoveries like that of Kobe, Japan (Bingler 2006). What seems indisputable, however, is the widespread frustration felt by New Orleans residents, especially those in damaged neighborhoods, at the slow pace of recovery, and their negative assessments of government efforts, at all levels – but their mostly warm feelings about their own community leaders (Schwartz 2006).

Indeed, observers since the beginning have stressed the importance and effectiveness of private, nonprofit, and community efforts – especially those of the faith-based community – and the slowness and ineffectiveness of government actions and managerial approaches (LANO 2006). The present research focuses on these "bottom-up" efforts.

Importance of Social Factors. We posit that the recovery from the disaster rests on three legs: (1) the degree of physical destruction (negatively), (2) the material and economic resources that people can bring to reconstruction, and (3) the contributions of social networks, community organizations, and leaders. Our research proposes to combine engineers' assessments of physical damage and repair, with geographers' spatial perspective, and with social science assessments of social factors. Investigators sometimes find it difficult to incorporate the social element, and we want to stress its importance in this proposal.

Importance of the Nonprofit Sector. A subsidiary proposition is that, while government, insurance, and other large businesses provide many of the resources for physical reconstruction, people's well-being and their decision to return and rebuild are heavily influenced by social factors. Observers have often commented on the importance of the nonprofit sector – faith-based organizations, neighborhood associations, community or relief organizations, and others. We propose to examine empirically the contribution of the nonprofit sector.

Best Practices. By approaching the question in this fashion, we hope to isolate the importance of specific actions and strategies, and thereby identify a number of best practices that social actors can adopt. In doing so, we do not expect that a single set will apply to all communities or all situations. On the contrary, we suspect that we will find a number of different routes to recovery. Some practices may be more or less useful for different communities or organizations, while others may be more universally applicable. We hope to identify a range of practices and strategies that diverse leaders can adopt for their communities.

Theoretical Perspective. Much research on disasters and disaster recovery is done from an expert, managerial, policy, and planning perspective. However, observers recognize that there have been many delays and shortcomings in government and expert response, and that the rates of recovery vary widely among different communities (Brinkley 2006; Horne 2006). Indeed, top-down perspectives acknowledge that intangible factors like social "resilience" play a major role, but they often find them difficult to explain.

Yet concepts like social resilience have a long history in social theory. Much current work on "social capital" stresses the importance of social networks, reciprocity, and interpersonal trust, which allow individuals and groups to accomplish greater things than they could by their isolated efforts (Coleman 1990; Putnam 2000, 2002, 2003; Lin et al 2001; Paxton 1999; Sampson et al. 2005; McPherson et al. 2006). Earlier, related, work on democracy and political participation stress the importance of community,

religion, family, social organizations – namely, civil society – in promoting the self-restraint that makes democratic government and a free-market economy possible (Verba and Nie 1972; Verba et al. 1995; Lipset 1981; Greeley 1997; Norris 1999; Putnam 1993, 2002; Skocpol and Fiorina 1999; Skocpol et al. 2000; Weil 1989, 1993, 1994a,b, 2000). These ideas can be traced back to the Federalist Papers, Adam Smith, John Locke, and earlier (Weil 1987). They probably come together most fully in the first empirical and theoretical accounts of modern democratic society by Alexis de Tocqueville (2000, 2001) (and to an extent, John Stuart Mill [1973]).

Tocqueville's account of democratic society centers on the concept of liberty, defined as local self-governance, in contrast to despotism, defined as centralized administration. In this view, free citizens who act together in community – using institutions of civil society like churches, voluntary associations, the press, and so on – are able to take immediate action to address issues that face them. They do not wait for a higher authority to solve problems for them, but rather, join together in addressing them themselves. They do not neglect self-interest; rather, it is moderated by a regard for the common good. In contrast, subjects of despotic government are like children clamoring for hand-outs from the authorities, and squabbling with each other. Each person regards only his or her own self-interest and is jealous of what anyone else gets. As a result, they are incapable of cooperating or acting for themselves and must wait for government to help them.

While few observers believe that the contrasts are as stark as Tocqueville paints them, or that a central authority is ever entirely absent or unnecessary, most modern theories of community or collective action accept the basic outlines of this account. In the present proposal, we also build on these concepts to try to account for why some communities have apparently made more progress in their recovery than others, net of physical damage, economic resources, and government assistance. We think this perspective can help us understand what community *strategies* have been most effective, and what we can learn from them in a general sense.

RESEARCH DESIGN AND METHODS

Our research design is meant to be straightforward but comprehensive for addressing our questions. At the core are *social surveys* of a wide variety of populations and communities, which focus especially on embeddedness in various communities and social networks. The surveys include measures of well-being and stress that can be evaluated from a *public and mental health* perspective. We will adjust or *weight this sample* with detailed pre-storm census information. We will also add independent measurements of storm damage and future flooding risk, provided by *civil engineering assessments* of respondents' dwellings and locations. We will do *surveys of organizations* that represent respondents' communities – especially faith-based, neighborhood associations, service organizations, and the like – in an attempt to link best practices with measured outcomes. (This is a multilevel analytical design.) And finally, we will do *geo-spatial mapping and analysis (GIS)* of all these and additional

elements. At all steps of the data collection and analysis, we will attempt to put as much usable information as possible into the hands of community leaders, who are in a position to actually help their community members and clients. A *Diagram of our Research Design* is shown in **Figure 1**. We now describe the elements in more detail.

Social Surveys. Normal telephone surveys are virtually impossible in Greater New Orleans since the hurricane, and door-to-door interviewing only reaches people who have returned and can be found at home (Airriess 2006; American Red Cross 2005; Banks 2006a,b; Collective Strength 2006; Henderson 2006; Howell et al. 2006a,b,c; Herrmann et al. 2006; Kessler 2006a,b; Morin 2005; Patel and Vogenbeck 2006; Prevention Research Center 2006; Texas HHS 2006; Washington Post 2005).

We pursue an alternative strategy: working with membership organizations that have the ability to contact their members and spread the word, whether members have returned to Greater New Orleans or not. This includes especially the faith-based community, but also neighborhood associations, social service providers, and others. We are currently conducting a *first wave* of the survey, which will be completed prior to funding under this proposal – and will not be funded under this proposal – and we plan *two further waves* that would be funded by this proposal.

The first wave is distributed by organizations to their members. **Table 1** indicates some of the organizations and partners that are distributing the survey. We began with the Jewish community – the Jewish Federation and synagogues in Greater New Orleans – and have collected about 700 responses. Other faith-based participants include the Catholic Archdiocese, the Episcopalian Diocese, Lutherans, Methodists, Baptists, A.M.E., and a number of other denominations – including their affiliated social service agencies. We are working especially closely with certain communities among them, like the Vietnamese of New Orleans East and the residents of Chalmette. We are also working with other organizations. WWOZ, with several partners, is doing the survey among displaced musicians, social aid and pleasure clubs, and Mardi Gras Indians. A couple dozen neighborhood associations are doing the survey with us. We are doing the survey among residents of the FEMA trailer communities and recipients of social services in Baton Rouge. We hope to reach out to evacuees in other regions – especially Texas and Atlanta – through New Orleans church branches and social service providers there. *It is important to note that the organizations have cooperated with us largely because we have already been doing relief and recovery work with them and have offered to share our information with them. This is a vital element.*

The first-wave survey is self-administered and is distributed partly on machine-readable (scannable) paper forms, and partly over the internet (at www.lsu.edu/katrinasurvey). This method was dictated partly because almost no funds were available to administer it at the time, and we felt it was important to begin as soon as possible. The survey is designed to be easy to distribute, and specific methods of distribution depend largely on the capabilities of the organizations and their members or clients. For example, the Jewish community survey was done almost entirely on the internet. Some churches put a notice in their bulletin and website, distribute paper copies after services, and ask

congregants to bring the completed surveys back the following week: we pick up the completed stacks. In other cases, we attend a gathering and distribute paper copies to be filled out at that time. Social service organizations administer it at their service centers or give it to case managers to administer to their clients. Neighborhood associations distribute it at their community meetings or through their block captains. Other, similar, methods are available. Community members and congregants reach out to family and friends who have not returned, and ask them to take the survey online or over the phone. We provide guidance to community leaders directly and also at this web page: www.lsu.edu/katrinasurvey/info.

The second wave of the survey will be conducted soon after funding begins; and the third wave will be conducted late in the funding period, in order to measure a maximum span of recovery time. The second and third waves will largely build on, and replicate, the first, in order to track change; but some new material will almost certainly be added in order to capture new issues that arise. The method of data collection will be different, in part. With sufficient funding available, the LSU Public Policy Research Lab (the LSU Survey Lab) will conduct telephone interviews. As part of the first wave, we ask respondents to voluntarily provide contact information, and we will attempt to re-contact those who have provided this information. We will also ask participating organizations to provide us contact lists to sample from, and will interview these people by telephone. We will also employ a snowball sampling procedure, analogous to the outreach we ask of respondents in the first wave. We will ask respondents for contact information for others in their community or congregation, and will interview these people by telephone, as well. And in cases where cooperation with organizations worked well, we will also ask them to distribute surveys to their members and clients in the same fashion as they did in the first wave.

Conditions are too difficult and unsettled among the dispersed New Orleans population for us to attempt a full panel survey design – it is difficult enough under the best of circumstances to re-contact respondents. But we may be able to re-interview respondents in some cases. We have developed an innovative method to re-identify respondents, without violating confidentiality. We ask respondents for the first three letters of their mother's first name and the day of the month of their birthday, their pre-Katrina street address, and the common questions of birth year and gender. Most respondents provide this information, and it will allow us to identify re-interviewed respondents in most cases. We will remove information from the records that would allow confidentiality to be revealed, once we have prepared the data set. The street location data will also be used for computer mapping and for conducting structural damage assessments, as described below.

The first survey wave has about 1300-1500 responses, as of mid-February 2007, and we believe it will grow to over 2,000 responses, possibly well more. We have budgeted for 1,000 telephone interviews for each of the second and third survey waves.

The survey instrument draws on previous research on social capital, social networks, community and social support, nonprofit and faith-based organizations, and a variety of

other fields. The questionnaire is available online at http://www.lsu.edu/katrinasurvey/lsukatrinasurvey-nolageneral.pdf. In particular, we use social capital indicators developed by Robert Putnam in his 2000 "Social Capital Community Benchmark Surveys" (Saguaro 2000). This was a multi-community survey, and Weil directed the Baton Rouge portion and has replicated the indexes in numerous subsequent Baton Rouge surveys (LSU Sociology 2007). We also replicate several questions used in national surveys in the aftermath of hurricane Katrina, and replicated by Weil, Shihadeh, and Lee in their NSF-supported post-Katrina Baton Rouge surveys (Weil 2006, 2007; Weil, Shihadeh, and Lee 2005, 2006). However, most of the survey instrument was developed by Weil on the basis of months of in-depth, unstructured interviews with community leaders, community members, evacuees, and clients of relief organizations, from a variety of communities and organizations.

The survey focuses on a range of objective activities and subjective feelings and views of respondents. These issues include: How much damage did community members sustain? What will it take to recover? Do people consider it worth it? Are they willing? Where did people go if and when they evacuated? Did their own community care for them? Who is staying, who is leaving, and why? Is it jobs? Family connections? Destruction and loss? Is it the strength and vibrancy of members' own community? The general community? Do community members feel safe and protected from future storms? What can leadership do to help people return and rebuild? How much did community members work together, cooperatively, during the aftermath and the recovery? How much cohesion is there within each community? What have the disasters meant to members spiritually? How much stress is there among community members, and what can help mitigate it? Do community members feel supported by their communities outside Greater New Orleans? Whom do community members praise and blame? How do community members differ on these questions among themselves – within families, between people who differ in their religiosity, their education, their economic standing, between age and gender groups, and so on.

This survey instrument and the sampling of the first wave – as a stand-alone study – already provide the basis for positing and testing a large range of causal models and hypotheses. **Figure 2** shows an overall *Causal Model* for this level of analysis. Examples of specific hypotheses are shown in **Table 2**. The examples in Row A are supported in preliminary analysis (Schwartz 2006; Weil 2007b):

- A.1 Those with higher damage experience more stress.
- A.2 Social support mitigates/reduces stress, even among those with higher damage. Thus, for example, stress rises steeply with damage for non-church-attenders, but is flatter for church-attenders.
- A.3 People express greater confidence in, and satisfaction with, their own community leaders (esp. religious, neighborhood, nonprofit) than with government officials.

We propose to add several levels or dimensions to this model, as we describe below.

Public and Mental Health. We place special emphasis on stress and health outcomes. In disasters, natural or otherwise, adults who have been displaced from their original communities are more likely to suffer long term mental health consequences (Bromet 2002). There is always a natural increase in the incidence of mental illness, predominantly affective disorder/anxiety related disorders after a natural disaster but in the case of Katrina, mental health researchers have hypothesized that the incidence of mental illness will be greater over time when compared to previous disasters (Rhoads, Mitchell, Rick 2006; Kessler 2006).

Our survey will help researchers understand what some of the longer term effects of Katrina might be on respondent's overall mental health now compared to prior to the hurricane. The domains relevant to the topic included in the questionnaire include:

- Sociodemographic Characteristics- including household size, age, gender, race, education, housing
- Stress and anxiety symptoms- based on Post-Traumatic Stress Disorder symptom questionnaire- both type and frequency of symptoms
- Mobility- times moved
- Available current resources to recover financially from disaster including dependence on governmental assistance
-

A multivariate model, stratified by household, can be expressed as:

> Stress Symptoms = fn (Sociodemographic, Preexisting Conditions, Degree to which Affected by Hurricane)

In addition, respondents were asked to identify how important health care and mental health care in their decision to return and rebuild in their original communities. A subgroup analysis of the respondents who answered that health care and mental health care are "very important" in their decision to return and rebuild versus those who did not think it was important would be very revealing.

Additionally, given the diverse ethnic and religious makeup of our respondents it would be helpful to see to what degree involvement with specific congregations/organizations predicts the degree to which people feel that healthcare services are important in their decision to return and rebuild. We know from Norris and colleagues that the degree to which people are dependent on healthcare/mental health services *prior* to the disaster predicts the degree to which these factors are important for returning and rebuilding their community (Norris, et al. 2002).

We will follow these processes over time in our second and third survey waves, and in the over-time data collected in other parts of the proposed research, described below. Because Patel is a physician and public/mental health expert, the present research lays a foundation for extending our investigation *beyond* that foreseen in the present proposal (that is, *not* included in the present proposal), for instance:

- Detailed Patient Health Questionnaire and Sickness Impact Profile assessments to measure public health effects of hurricane and correlating geographic information with these health outcomes;
- Health of household- propose to draw a random sub sample of current respondents and interview household to assess health care access, utilization and correlation with geologic data as well as regional air quality and proximity to health care sources including tertiary care hospitals, clinics, primary care providers

Weighting the Sample. The raw sample we obtain from the various communities, service providers, and others, cannot be expected to be representative of anything except those communities or the clients they serve. Such a sample would, indeed, allow us to compare communities and groups; but it would allow only limited inferences about the whole regional population. Furthermore, we may expect to have only variable levels of success in sampling evacuees and returnees in their real proportion. Our sample of the Jewish community achieved roughly correct proportions, but this community may prove to be the easiest to sample and to produce the most representative sample of the target community.

However, it may be possible to achieve an accurate picture of the Greater New Orleans population in its dispersal by weighting our sample by the region's census characteristics from before Katrina. If we interview reasonable numbers of people from all important groups, from all major parts of the region, and who have or have not returned, we may be able to adjust the proportions to create a representative sample. Our statistics consultant, Dr. David Banks of Duke University, will help us obtain the multivariate breakdowns of pre-storm census data needed to weight the sample. The questionnaire includes the requisite variables.

By these means, we will adjust a combined quota-, convenience-, and snowball sample into a relatively representative one. We will not claim more for the sample than is warranted, but it is worth noting that many current multi-stage and RDD samples have some of these characteristics and still claim to be representative. Very high quality probability samples exist and set the standard, of course. But many of the more common, lower quality samples are likely to differ from ours more in degree than in kind.

Civil Engineering Damage and Recovery Assessments. A critical component of the research design is understanding the physical damage and recovery characteristics of respondents' homes and neighborhoods and the relationship of physical recovery with subjective-personal and social recovery.

We propose to monitor respondents' recovery across multiple fronts throughout the project. We will be able to do so through issues addressed both in our social survey and through physical monitoring. By performing periodic evaluations and collecting photographic records of the physical recovery progress, the research aims to document a multi-temporal recovery trajectory for each of the subject buildings. In some places, we expect that full physical recovery will have been achieved early in the study, while in

others, it is anticipated that full recovery will not occur within the duration of the project. Our base hypothesis is that the speed and completeness of rebuilding is inversely proportionate to the level of damage sustained. That is, the more severe the damage, the slower and less complete the rebuilding will be.

We propose to conduct external engineering assessments after each wave of social surveys to assess the levels of damage and recovery on per structure and neighborhood bases. These independent assessments are critical in evaluating the level of effort required to physically rebuild, in comparing physical damage and respondents' perceptions of damage, in gauging the relative importance of actual damage and perceived damage in the recovery process, and in providing periodic assessments of the level and progression of recovery in the study area.

Several methodologies have been utilized in post-Katrina New Orleans by FEMA, the City of New Orleans and others to assess the level of building damage caused by the combination of wind and flood damage (ATC 2004, FEMA 2006, 2004, 2003a, 2003b, Womble et al. 2006,). While the project team has successfully implemented multiple damage survey techniques using damage scales of varying levels of detail in New Orleans and the Mississippi coast, the number and variety of methods that have very recently been used necessitates a comparison of these methodologies for the purposes of consistency. Once this comparison is complete, a single street level damage methodology will be implemented for the structural damage assessment. Field documentation will consist of a written checklist, photographs and video where appropriate. Damage assessments will be conducted by graduate and upperclassmen undergraduate students from LSU's Departments of Civil Engineering, Architecture and Construction Management.

For each residence, the initial field survey will consist of recording pertinent building inventory information including building type, number of stories, foundation type, etc. Residual building damage from Hurricane Katrina will be recorded, along with specific details of damage. The initial field survey will also note specific indicators of recovery and will serve as a benchmark for subsequent field recovery assessments. We will assess damage and recovery for structures identified using the three distinct sampling methodologies outlined below.

Social Survey Sampling: Social survey respondents are asked to provide their address at the time of Hurricane Katrina. The addresses indicated by the surveys will be located using GIS, and a field reconnaissance plan will be made to most efficiently gather data. For each structure that is uniquely identified through the social surveys, a team of trained engineers and students will be sent from LSU to record damage as described above.

Neighborhood Spatial Sampling: Some wave 1 survey respondents chose not to provide an address, but indicated either a neighborhood or zip code. The data provided by these respondents can still be matched to physical descriptors of damage, but in a neighborhood manner, with this level of sampling also contained within the GIS

database. If sufficient structures in a neighborhood are uniquely identified and are considered to describe, in the aggregate, the typical damage for the neighborhood, no additional structures will be selected for assessment. However, where an inadequate number of buildings are identified from the social surveys, additional buildings will be spatially sampled using GIS to provide a more complete picture of damage caused by Hurricane Katrina.

Damage to buildings selected through neighborhood spatial sampling will be assessed using the same techniques as for buildings identified through the social surveys. Neighborhood-level data will be selected to complement the buildings identified by the social surveys, and also to reflect the differences across income levels, race, and storm damage that may be typified by a neighborhood-level assessment. Potential neighborhoods include Lower Ninth Ward, East Orleans, Gentilly, Lakeview, and Garden District.

Past Damage Survey Sampling: Information collected in the damage surveys will provide an indication of levels of post-Katrina damage; however, much recovery has taken place in many areas since August 2005. In order to more accurately describe the immediate post-storm damage states, past damage survey results will be reviewed. Carol Friedland collaborated with MCEER and served as the lead engineering expert in an NSF-supported effort to collect geo-referenced high definition video defining the extent of hurricane damage for much of Orleans Parish in early October 2005 (Womble et al. 2006). This data can provide valuable information about the post-storm condition of residences and neighborhoods and will be systematically sampled throughout the study area. Additionally, buildings surveyed in the MCEER assessment that are also identified through either the social surveys or the neighborhood spatial sampling will be reviewed to provide a complete history of damage and recovery for the structure.

In addition to field data collected as part of this research and data derived from past damage assessments, we are also able to calculate flood damage to buildings using standard depth-damage relationships. As part of the field assessments, first floor height will be approximated by counting the number of steps. Incorporating LIDAR (Light Detection and Ranging) bare ground elevation data with the height of the first floor, a first floor elevation can be approximately determined for each building through GIS analysis (Friedland et al. 2006). By comparing this elevation with the known elevations of flooding throughout New Orleans, the maximum depth of flooding within each building can be determined, and various methodologies are available that indicate direct depth-damage ratios, as well as repair cost indices for damage due to flooding (GEC 1996, FEMA 2003b).

Using these three methods of assessing physical damage, we will develop independently-measured housing recovery estimates for each resident. These estimates will be compared with social survey responses regarding repair funds and insurance coverage. Approximate or qualitative comparisons (e.g., quartiles) will be unproblematic, but more precise estimates may also prove possible. These estimates and assessments become part of each respondent's record, located within the GIS

framework, and various types of analysis become possible, which, without externally measured damage information, are much less reliable.

We will be able to compare respondents' subjective impressions of their damage, future risk, and likelihood of repair with the physical conditions of their specific and general environments, determined through engineering estimates. Respondents' reported recovery activities and expenses will be evaluated in light of both physical housing damage and calculated recovery costs. We will also analyze how subjective impressions vary across groups and other measured demographic characteristics – and we will be able to identify groups, traits, and conditions under which people evidently are not getting correct information, not assessing risks accurately, or on the contrary, may know things that engineers are not able to estimate using standard techniques (for example, the efficacy of group effort in making repairs).

The causal direction can possibly also be reversed, as suggested by the last example. Characteristics of individuals and communities may affect the likelihood of physical recovery. Besides group effort, it may be valuable to know about "tipping points" in recovery, as "critical masses" of people repopulate certain areas. We can make estimates simply from physical characteristics and physical return rates, but we can also obtain deeper knowledge – which respondents on the ground may have more of than our engineers – about who is likely to return and what people's impressions are about others' intentions.

Through estimation of building damage and physical recovery activities, we expect to address hypotheses such as those shown in Table 2, Rows B and D:

- B.1 The more damage a residence suffered, the slower and less complete the rebuilding.
- D.1 The more resources (esp. money) an individual has, the faster and more complete the rebuilding.
- D.2 The more solidarity among community members – e.g., the more embedded individuals are, the more individuals work cooperatively with others, the more effective the leadership – the faster and more complete the rebuilding.
- D.3 The more complete the rebuilding, the lower the individual stress.
- D.4 The more complete the rebuilding, the more social support (social networks, embeddedness, community leadership) will recover.

Surveys of Organizations. Besides surveying individual respondents and assessing physical damage and repair of residences and neighborhoods, we propose to survey organizations to which respondents belong or which serve them as clients. We want to investigate what strategies, actions, and forms of organization leaders employ, and how effective they are, net of other factors.

For instance, the Jewish community engaged in a number of disaster response, relief, and recovery efforts (Daroff 2006). On one hand, it mobilized its resources nationally, coordinated with national and local officials, and took initiatives without waiting for

requests; and in the midst of helping their own community members, Jewish organizations organized aid for others as well. On the other hand, it acted locally. The Jewish Federation of Greater Baton Rouge (JFGBR) organized a rescue effort in the first days after the storm. Calls came in from concerned New Orleans Jewish community members about missing persons. Together with off-duty Baton Rouge Sherriff's department officers, JFGBR members compiled lists of addresses to check, sent boats to the areas guided by GPS and 2-way radio contact. They rescued everyone for whom they had a name. They likewise evacuated Torah scrolls (personal communications).

The leadership of the Vietnamese community in New Orleans East followed a different, but equally effective, strategy. The community evacuated everyone who would leave and alerted Vietnamese communities in the surrounding areas that they would be coming. Community members arrived at local Vietnamese shopping centers, and local community members came out and indicated how many evacuees they could house. Meanwhile, community leaders like Fr. Nguyen The Vien remained in New Orleans during the storm and subsequent flood, tending to community members in need. As soon as he was able, Fr. Vien drove around the region with a digital camera and laptop computer, contacting community members. He took pictures of community members, showed them to each other, and assured them that their loved ones were safe. He then assured everyone that up-coming community festivals would proceed as planned and encouraged everyone to return. On their return, community members did a good deal of relief/recovery work together, and pressed city officials for a resumption of water and electrical service (personal communications).

We will conduct interviews with organizational leaders, following the second and third waves of our social surveys and engineering data collection, merge the information (see below), and conduct multi-level and spatial analysis of the resulting data sets. We will base our surveys on (a) prior work done in Baton Rouge by team members Daphne Cain and Juan Barthelemy, and (b) information that emerges from our in-depth interviews with leaders and the results of our social surveys.

Cain and Barthelemy surveyed churches in the Baton Rouge metropolitan area in the first half of 2006. Church representatives were asked to respond to a 26-item survey requesting information about the tangible and spiritual relief efforts provided to evacuees following Katrina. The questionnaire is available at: http://www.lsu.edu/katrinasurvey/CainBarthelemy-BRChurchSurvey2006.pdf. A total of 157 religious institutions, representing 20 different denominations, completed the survey, which was sent to 603 churches (a 26% response rate). Results reveal that Baton Rouge area churches were extensively involved in relief efforts immediately after the hurricanes, and for extended periods of time thereafter. The most common resources provided by churches included food, clothing, and financial assistance. Nearly 75% of churches attempted to connect evacuees with outside state and federal resources including FEMA and the Red Cross, and just under half attempted to reconnect evacuees with family outside of the Baton Rouge area. The majority of churches paid for evacuee care with congregation and private donations, only 1 church

received federal financial assistance. Churches reported that the greatest unmet needs included evacuee shelter and housing, and on-site computer and internet access. Churches recommend preparedness, triage care, and leadership among the advice they would give to other churches who find themselves the first responders following disaster. Themes of sermons following the hurricanes included restoration, rebuilding, and "raising up" and repairing the foundations of not only homes but lives.

We propose to revise and expand Cain and Barthelemy's survey. We will interview leaders of the same churches and organizations that distribute the survey to their members or clients and develop multilevel models for the data analysis. Thus, we expect to find variation in recovery rates among community members, which can be compared with variation in strategies and practices among community leaders. By pursuing this form of analysis, we aim to identify and isolate not just the most successful communities, but rather, or especially, the *best practices*: particular courses of action that work in certain circumstances or in most circumstances. Examples of hypotheses are given in row E of Table 2.

Georeferencing and Spatial Analysis (GIS). Geographic Information System (GIS) will be used to input, store, analyze and visualize all geo-referenced data collected in this study. Following the collection of survey data on individuals and organizations, we will georeference survey responses that will be merged with engineering information and infrastructure characteristics of the local areas. Project staff from the LSU *CADGIS (Computer Aided Design and Geographic Information Systems Laboratory)* will georeference survey responses based on address data from survey respondents. Using GIS software packages, such as ESRI ARCVIEW and ARCGIS, we will assign latitude and longitude coordinates to each survey respondent. This will allow project staff to link each respondent to a neighborhood or other spatial unit, such as a city block.

Georeferencing is an important part of this project because it merges contextual data to individual-level information. For example, a key component of our analysis is to assess the degree to which neighborhood social factors, such as an active religious and secular organizational base, influence a household's hurricane recovery. Georeferencing survey response provides a means to attach information on the presence and activities of neighborhood organizations to individual survey respondents. The merging of data by spatial location is central to our project because our research hypotheses are multilevel in nature and require data collected at a variety of spatial units of analysis.

For instance, GIS will be used to investigate how the proximity of resources or problem factors affect rebuilding efforts, or how the proximity of physical gathering places affect social-network, leadership, or organizational outcomes. Examples of such hypotheses are shown in rows C and F of Table 2:

C.1 The more proximate resources are – e.g., groceries, pharmacies, schools – the faster and more complete the rebuilding.

C.2 The more proximate problems are – e.g., crime, devastation in other neighborhoods – the slower and less complete the rebuilding.

F.1 The proximity of physical gathering-places – e.g., undamaged or repaired schools, restaurants, places of worship, community centers – may “explain away” the effects of social-network, leadership, or organizational factors. That is, social support may only become possible when physical structures are available where people can gather.

The analysis of spatial data will proceed at three different levels. The first level of analysis can be described as Exploratory Spatial Data Analysis (ESDA). The purpose of ESDA is to get a better feel for and to identify relationships between data. Examples of ESDA that will be conducted in this study include spatial queries (e.g., number of groceries, pharmacies) and their distances to rebuilding efforts.

The second level of analysis will include mapping of spatially queried data in the form of dot, choropleth, or proportional symbol maps. Such quantitative thematic maps will show the spatial distribution of one data variable at a time (e.g., the distribution of crime rates or the level of devastation across selected neighborhoods) or the spatial relationship between two or three data variables (e.g., the relationship between places of worship and strength of the social-network).

The third level of analysis is the most comprehensive and will include the identification of spatial clusters (e.g., the number of resources per spatial unit and problem areas with high crime rates) as well as the impact the proximity of physical gathering places has on social-network, leadership, or organizational factors.

For example, we can identify ‘hot spots’ of organizational activity using spatial cluster analysis (Everitt, 1974), nearest neighbor hierarchical clustering, kernel density estimation (Bailey and Gatrell 1995), and Local Indicators of Spatial Autocorrelation (Anselin 1995). These methods provide a means of using ecological data, such as neighborhood information, or event data, such as engineering reports, to identify areas with significantly high or low rates of a given characteristics.

Although our analysis focuses on the multilevel relationship between local area characteristics and individual-level outcomes, we will also explore the possibility of aggregating our survey data by ecological units to assess reciprocal relationships. For example, we will explore the possibility that the average level of recovery may bolster social dynamics, such as leadership capacity and collective efficacy, in a given locality. To explore these issues, we will conduct spatial regression analysis (Fotheringham 2002). Ordinary least squares regressions applied to spatial data are problematic because they assume spatial randomness and ignore the spatial nonstationarity in the relationship between the dependent and the independent variable(s). For this reason, local spatial regression models should be applied instead of the global OLS regression. The geographically weighted regression (GWR) analysis is a relatively new technique that extends the least squares regression estimation process by recognizing the influence of neighboring data values on the point of interest.

Finally, georeferencing survey data introduces additional concerns about respondent confidentiality that we must take into account. Spatial confidentiality refers to the likelihood that an individual, whose residence is displayed on a map, can be identified together with his/her personal information that is attached to his/her residence. In order to preserve somebody's individual privacy, the likelihood of detection must be kept as low as possible. Different methods to preserve somebody's individual privacy have been suggested and include data aggregation and geographic masking (Armstrong, et al. 1999; Leitner & Curtis 2006). It is important that geographically masked data cannot be re-engineered to their original location (Curtis et al. 2006). This research team has considerable experience working with data that are spatially confidential. This is an important asset for this proposed study, since all address-level and some neighborhood data would compromise individual privacy, if data were not properly masked.

Address-level data that will be collected for this research will be aggregated or geographically masked before being used in presentations, included in publications or shared with the media. Similarly, results of spatial analysis will also be aggregated or geographically masked, if necessary. Address-level data will also be shared with other researchers. This data-sharing will take place in secured environments, where the researcher can look at the data and can do any type of spatial analysis, but agrees to not take any original address-level data with him/her. The researcher is allowed to keep all analysis results.

STRATEGY OF ANALYSIS: COMBINING THE SOCIAL, ENGINEERING, AND GEOGRAPHIC COMPONENTS

At the outset, we indicated that New Orleans' recovery from Hurricane Katrina rests on three legs, physical damage (negatively), economic resources, and social factors. Having sketched the elements of a measurement strategy, we now indicate how we propose to bring the pieces together in an analysis of a unified model of recovery. **Figure 3** shows such a model. In the center oval is a representation of our basic model.

The left panel of Figure 3 summarizes the indicators and measurement strategy we have outlined above: it shows how we operationalize the *independent variables*.

Physical Damage is measured by structural engineering assessments of residential units, as described above. We also apply data from flood maps to assess both the water depth and future risks at each location point. And we consider geographical factors like proximity to needed resources. We combine these factors in a GIS analysis.

Economic Assets are measured mainly at the individual level in the surveys, where we ask respondents about their employment status, income, and access to capital for rebuilding.

Social Factors are conceived in two parts, each measured by our individual and organizational surveys. First, Social Capital is measured by embeddedness in networks of social support and the effectiveness of communal organizations, especially those in the nonprofit and faith-based sectors. Along with this, we will compute the gaps between individual risk perceptions and engineers' risk and recovery assessments, aggregate these gaps to the community level, and analyze the size of gaps across communities.

A second aspect of the Social Factors can be characterized as Social Dynamics**.** As we noted, individuals may be unwilling to return and rebuild if they believe they would be isolated; and impressions of isolation or a "critical mass" may produce self-fulfilling prophecies. We measure respondents' impressions in repeated surveys and will look for tipping points in the dynamics, as recovery proceeds or stalls. We believe that these tipping points are likely to be influenced by the strategies and effectiveness of leadership, the solidarity and trust within communities leading to a sense of collective efficacy, and possible cooperation between communities or organizations. The organizational surveys will help us measure these factors, and we will combine them in a multi-level analysis design.

We now indicate how we will operationalize our assessment of disaster recovery, in other words, how we will assess the *dependent variables*. Three aspects of recovery outcomes seem important, which partly correspond to the "three legs" on which recovery rests. These are the (a) Material, (b) Emotional and Spiritual, and (c) Community elements of recovery. They are shown in the right panel of Figure 3.

Material Recovery consists of housing recovery, neighborhood revival, and economic recovery. We measure these factors with all our tools: structural and flood engineering, GIS, and (mainly individual) surveys. Measurement of housing repair and recovery is relatively straightforward and will be done by repeated observations (filmed and direct) and, when necessary, by interpolation from our engineering models. Neighborhood revival will be measured by our and external measures of repopulation, and the re-emergence and accessibility of neighborhood resources like grocery stores, pharmacies, schools, other retail outlets, and the like. Using GIS, we will spatially analyze these factors and will be able to draw associations between housing recovery and neighborhood revival. And economic recovery will be measured by survey questions, repeated over time, about employment, income, access to capital, as well as economic elements of the above factors.

Emotional and Spiritual Recovery will be measured mainly by our surveys of individuals. Our survey includes measures of emotional stress, manifested in physical symptoms like sleeplessness or trouble concentrating; spiritual feelings; comfort and satisfaction with family, friends, and community; as well as various subjective evaluations of respondents' communities and leaders. Because we link material and organizational indicators to individual records, we can analyze the influence of these factors from a spatial (GIS) and multi-level perspective. Thus, for instance, we should be able to

evaluate whether successful leadership strategies, or geographical proximity to resources, result in greater individual emotional recovery.

Community Recovery is perhaps the subtlest element to evaluate. Some elements can be measured simply by aggregating individual-level responses. For instance, we could gauge community recovery by the extent of social support people feel, their embedded in social networks, their degree of trust or satisfaction with their leaders and communities, and similar factors. However, more sophisticated indicators can be developed, with varying degrees of difficulty. For instance, research on democracy suggests that polarized polities have more trouble resolving problems and conflicts (Weil 1989, 1994b). We can assess community polarization by measuring the dispersal of community members' evaluations of their leaders (e.g., a standard deviation), and compare communities with each other on this polarization indicator. The more polarized a community, perhaps, the lower the emotional/spiritual or even material recovery (Hypothesis E.4 in Table 2). This is a multi-level research design. Likewise, certain leadership strategies, or organizational networks may indicate a better-functioning community environment. We can analyze their effects on individual-level outcomes, again in a multi-level analysis – but it may also prove possible to evaluate the relative success of different trajectories of these macro-level developments. This would be more uncharted territory and would probably have to be exploratory in the present research.

IMPACT ON SCHOLARSHIP AND COMMUNITY

This research attempts to knit together disparate fields of social and engineering sciences in a unified approach that we hope will yield fruitful insights and methods for further research. In addition, our research attempts to bring immediate benefits to the communities we study. At a minimum, we will pass on our findings to communities as soon as we have them. But more than this, we are actively working and consulting with a wide range of communities in their recovery efforts, including the Catholic Archdiocese, the Jewish Federation, other faith-based organizations, and individual churches; advocacy organizations like ACORN and PNOLA (representing mostly lower-income African American residents of the Ninth Ward, New Orleans East, and Central City); the Vietnamese communities of New Orleans East and the West Bank; the community of Chalmette in St. Bernard Parish; many neighborhood associations in different parts of the region; social service organizations like the Red Cross, the United Way, and Catholic Charities; advocates for displaced musicians like public radio station WWOZ and Preservation Hall; and resident leaders of FEMA trailer villages. In all cases, we try to help groups use the information we develop for their own recovery efforts.

Incidentally, we do not believe that these efforts of cooperation and assistance will somehow "contaminate" our research. On the contrary, we expect that (1) there will still be a large amount of variance on relevant variables to be measured and analyzed, and (2) active involvement will aid our understanding of the dynamic processes we are

investigating. Furthermore, the “Tuskeegee Experiments” long ago discredited the failure to help where possible, and current ethics of drug-trial experiments affirm the practice of helping where possible, or at least of doing no harm if it becomes clear that harm is being done.

Table 1

Organizations Participating in the Surveys
(Examples)

- **Faith-Based Organizations**
  - AME [African Methodist Episcopal]
  - Baptists
  - Catholic Archdiocese and Parish Churches – including Chalmette and the Vietnamese – and Catholic Charities
  - Episcopalian Diocese
  - Jewish Federation, Synagogues, and Community Centers
  - Lutherans
  - Methodists
- **Neighborhood Associations**
  - About 30 Associations
- **Nonprofit Organizations**
  - The Louisiana Association of Nonprofit Organizations, and their New Orleans branch, Nonprofit Central
  - Large and umbrella organizations like the Red Cross, the United Way, the Greater New Orleans Disaster Recovery Partnership
  - Organizations of volunteers like Americorps
  - Membership organizations that extend beyond particular neighborhoods
  - Organizations that focus on helping musicians return, like WWOZ public radio, Preservation Hall
- **Baton Rouge Sites for Evacuees**
  - Service Providers (a half dozen)
  - Renaissance Village and other FEMA and private trailer parks
- **Political leaders**
  - Members of the New Orleans City Council
  - Members of the State Legislature
- **Students, Interns, & Volunteers**, from LSU and Greater New Orleans universities

Table 2

Examples of Specific Hypotheses

<table>
<tr><th>Data Level</th><th>Examples of Specific Hypotheses</th></tr>
<tr><td>A. Social (Individual)</td><td>1. Those with higher damage experience more stress.
2. Social Support mitigates/reduces stress, even among those with higher damage. Thus, for example, Stress rises steeply with damage for non-church-attenders, but is flatter for church-attenders.
3. People will express greater confidence in, and satisfaction with, their own community leaders (esp. religious, neighborhood, nonprofit) than with government officials.</td></tr>
<tr><td>B. Engineering</td><td>1. The more damage a residence suffered, the slower and less complete the rebuilding.</td></tr>
<tr><td>C. GIS</td><td>1. The more proximate resources are – e.g., groceries, pharmacies, schools – the faster and more complete the rebuilding.
2. The more proximate problems are – e.g., crime, devastation in other neighborhoods – the slower and less complete the rebuilding.</td></tr>
<tr><td>D. Social-Engineering</td><td>1. The more resources (esp. money) an individual has, the faster and more complete the rebuilding.
2. The more solidarity among community members – e.g., the more embedded individuals are, the more individuals work cooperatively with others, the more effective the leadership – the faster and more complete the rebuilding.
3. The more complete the rebuilding, the lower the individual stress.
4. The more complete the rebuilding, the more social support – social networks, embeddedness, community leadership – will recover.</td></tr>
<tr><td>E. Social-Organizational</td><td>1. The more effective organizational leadership is, the faster and more complete the recovery, as measured in rebuilding and stress levels.
2. Organizational leadership can be broken down into discrete strategies and actions. Thus, discrete hypotheses become possible:
a. Communities will differ as to whether collective or individual effort is more effective.
b. Communities will differ as to whether decentralized or centralized decision-making is more effective. E.g., congregational denominations may have more effective decentralized decision-making, while hierarchical denominations may have more effective centralized decision-making.
3. The more effective organizational leadership is, the lower the gap will be between (a) individuals' perceptions and (b) engineers assessments of flood risk, recovery chances, etc. The reason for this is that effective leadership disseminates accurate information more effectively.
4. The more polarized a community's membership is – the more internal conflict there is – the slower and less complete the recovery.</td></tr>
<tr><td>F. Social-GIS</td><td>1. The proximity of physical gathering-places – e.g., undamaged or repaired schools, restaurants, places of worship, community centers – may "explain away" the effects of social-network, leadership, or organizational factors. That is, social support may only become possible when physical structures are available where people can gather.</td></tr>
</table>

Figure 1

Reconstituting Community:
Varieties of Social Capital in Disaster Recovery

Diagram of Research Plan

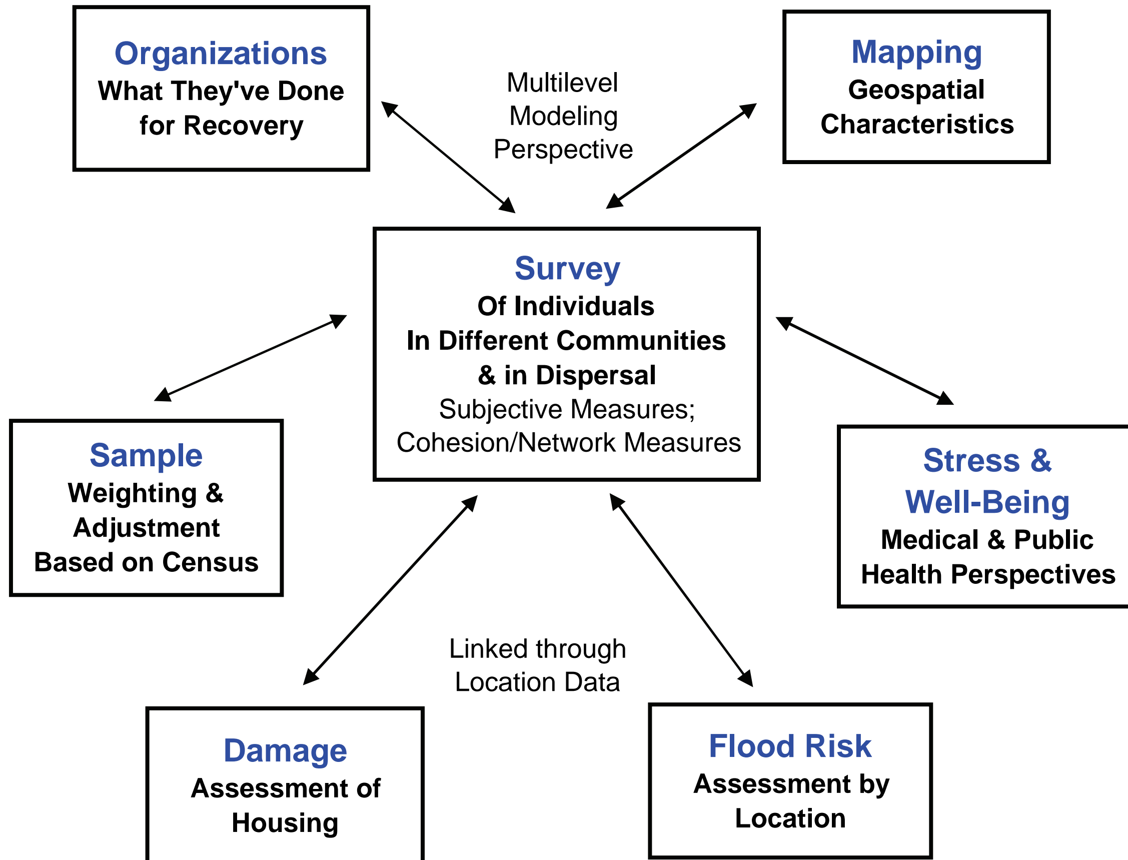
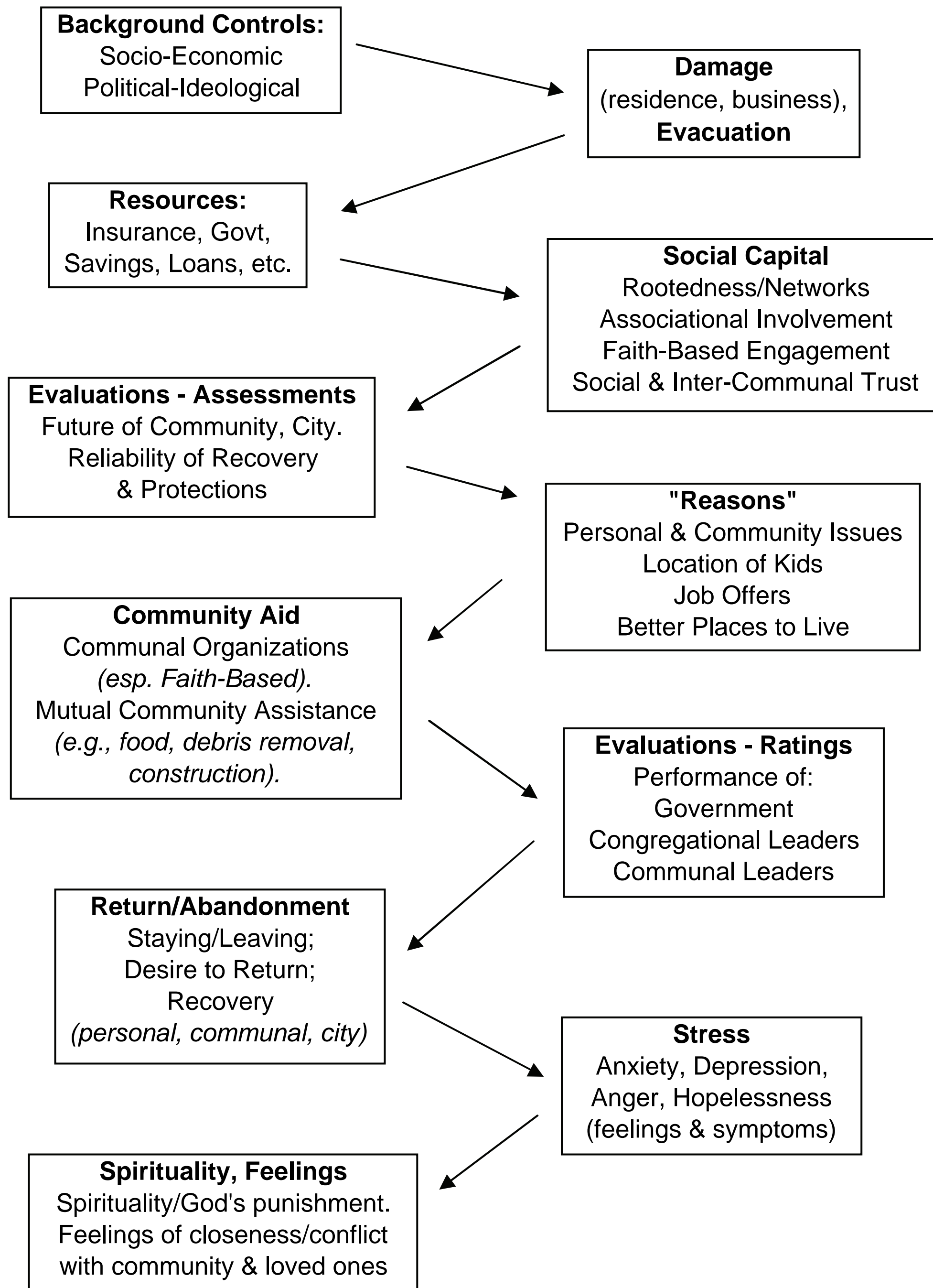


Figure 2

Causal Model* of Recovery from Disaster: Post-Katrina New Orleans
Employing Individual-Level Social Surveys

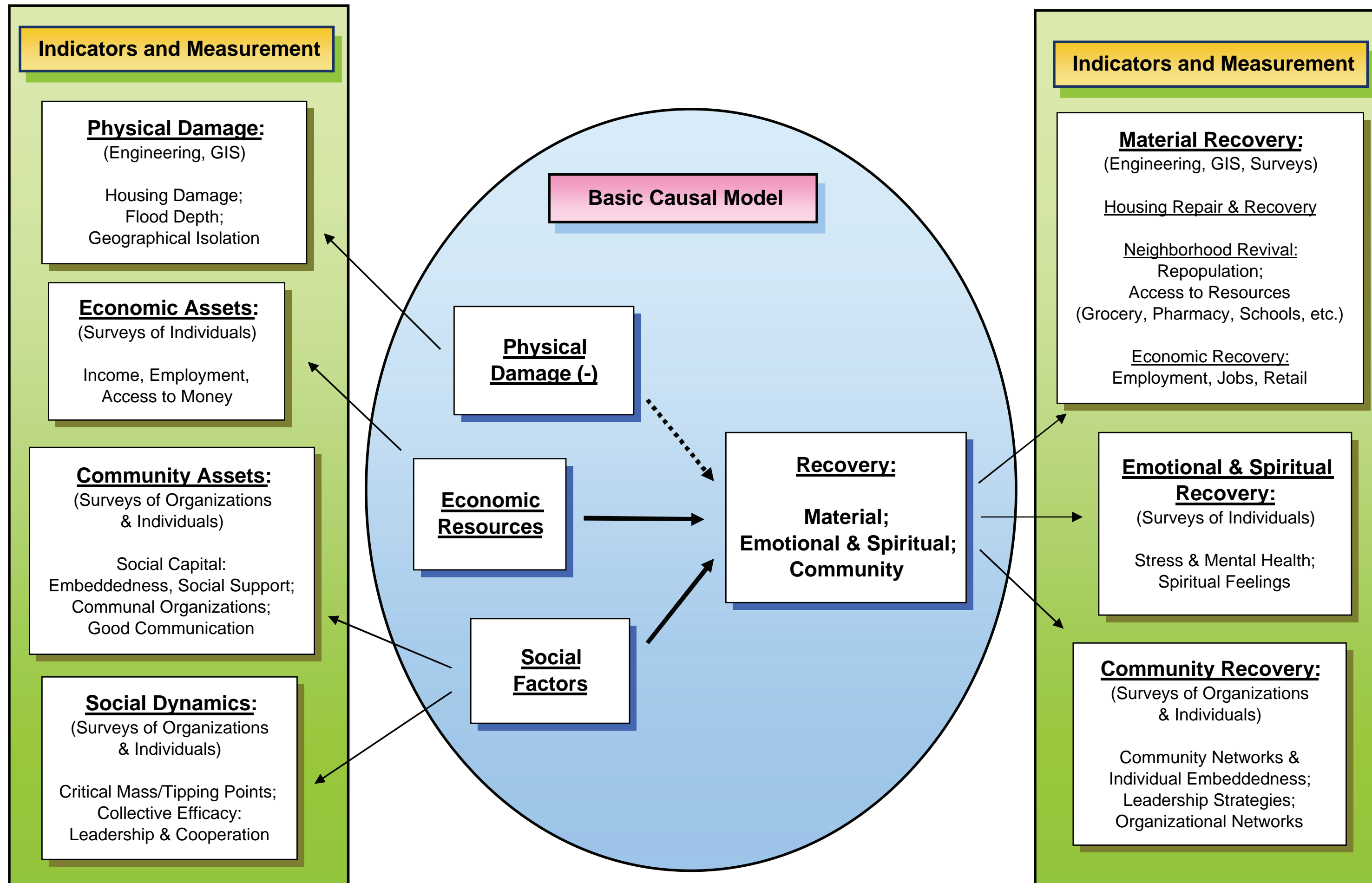


*Note: Causal order, as shown here, is hypothesized to be plausible, but may differ from this order. Preliminary analysis, using data collected since June 2006 from a variety of communities supports the hypotheses in this model.

Figure 3

Causal Model of Recovery from Disaster: Post-Katrina New Orleans

A Multi-Method, Multi-Level Model,
Employing Social & Organizational Surveys, Structural Engineering Assessments, and GIS Mapping



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