Working *Together*

TO CHANGE THE LIVES OF CHILDREN AND FAMILIES

FEWER THAN one in four children with an impairing psychiatric disorder ever comes to the attention of any mental health professional. Yet increasing evidence shows that early intervention helps children develop more normally and improves their functioning as adults. Finding a reliable, affordable, nonintrusive method to identify children who need help is the sort of complex, real-world challenge that excites researchers and demands a multifaceted approach.

Two researchers at Duke, from disparate fields, are collaborating to create diagnostic tools that could lead to early identification of at-risk children. Dr. Helen Egger, chief of the Division of Child and Family Mental Health and Developmental Neuroscience at Duke University Medical Center, has several years' worth of videotapes of children and their parents that must be coded manually, a time-consuming process. Pratt engineering and computer science professor Guillermo Sapiro has the video imaging analysis expertise, as well as proficiency with novel computational approaches to multimodal large data sets, to develop new methods for automated analysis of these data.

"You can manually annotate 100 videos," Sapiro said, "but not 10,000."

Jointly, Egger and Sapiro are putting together a project that unobtrusively installs inexpensive video cameras in a Durham public elementary school classr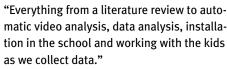oom and in Duke's Early Childhood Research Lab to record anxiety behaviors of children, and then automatically analyze the data. Sapiro envisions giving video equipment to Duke students who travel abroad, enabling him and Egger to do cross-cultural studies examining, for instance, whether the behavioral triggers of anxiety are the same in Tanzania as in the U.S.

The results could lead to an inexpensive way to identify children from all walks of life and across cultures who could benefit from support services.

"This is not ivory tower research," Egger said. "We're doing work that we hope will change the lives of children and families."

Egger and Sapiro are augmenting their research team with the help of *Bass Connections*, an initiative announced in January funded by a $50 million gift from Duke trustee Anne Bass and her husband, Robert. *Bass Connections* aims for a new education model that gathers scholars at all levels, from undergraduates to postdocs and professional-school students to senior faculty, across all 10 schools at Duke to tackle interdisciplinary research on real-world problems. Within days of the *Bass Connections* announcement, Egger and Sapiro had interviewed four students who wanted to join the team.

"We have multiple things for students of almost any discipline to do," Sapiro said.

"Everything from a literature review to automatic video analysis, data analysis, installation in the school and working with the kids as we collect data."

Egger and Sapiro will move their teams to SSRI West, space under renovation in Gross Hall that will enable social scientists and experts in big data and information futures to cross paths and share ideas. Sapiro had recently come to Duke from the University of Minnesota, where his research included analyzing videotapes of a preschool classroom and at a clinic to screen for autism. Egger has been at Duke since her residency and for years has been conducting large-scale epidemiological studies of anxiety disorders in preschoolers. For the past decade in the Duke Early Childhood Research Program, she and another colleague, Dr. Adrian Angold, have assessed more than 2,000 preschool-age children, including videotaping assessments with more than 500 children and their parents.

Clockwise from top: Sapiro and Egger pose with their MRI machine; waiting room for children and families; faculty, researchers and students discuss their project on identifying at-risk children.

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>
> —DR. HELEN EGGER

"We have one of the largest data sets with in-depth, multimodal assessments with community populations of young children and their families," Egger said. "These data, collected over more than a decade, provide a unique opportunity for data mining."

Developing automated, time-efficient, individualized methods for analysis and interpretation of data opens the door to analysis of big data of magnitudes never studied before in this discipline.

The collaboration, enhanced by the *Bass Connections* team, marks the first time Egger has worked with undergraduates. On the faculty of Duke Medicine, she teaches and mentors medical students, residents, and postdocs, bringing an understanding of the medical education model.

"In doing, you learn," she said. "That's how you train in medicine."

The interdisciplinary, multilevel team Egger and Sapiro are building epitomizes Duke's long-standing culture of collaboration across schools and disciplines, said Susan Roth, vice provost for interdisciplinary studies.

"We're building integrated pathways for students who want a particular expertise that intersects with real problems in the world," Roth said. "Conversations will run across the university among people who wouldn't typically meet."

Hallie Knuffman, the liaison from the Office of Interdisciplinary Studies who coordinates *Bass Connections*, sees Duke at the forefront of such interdisciplinary research. "Collaboration is easier to do at Duke than at other universities," she said. Even the layout of the physical campus helps. "At a lot of universities, the medical campus is miles away," she said. "At Duke, it's a 10-minute walk from the main campus."

Students who join the Egger-Sapiro team have the opportunity to work with engineers, mathematicians, developmental epidemiologists, early childhood psychiatrists, and developmental neuroscientists to apply computational analytic approaches and data mining to the videotapes Egger has compiled already. The team also plans to use robotics to develop cost-effective, easy-to-use tools to collect data.

"Everything opens tons of research questions," Sapiro said. "We don't know how to solve all these problems. A tough problem is great for my students and for me."

Egger recently received a $1.6 million Duke Endowment grant to build an integrated pediatric mental health coalition from Duke and the community that includes public schools, pediatricians, and mental health professionals to improve the mental health care for children in Durham. She and Sapiro have applied for additional grants to cover the cost of equipment and to support their study.

Within the next few months, Egger and Sapiro hope to install a data-collection videotaping system in a classroom in one of the poorest performing public schools that serves some of the neediest students in Durham.

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Sapiro finds the immediate application of his research very satisfying.

"One of our main challenges as a society is to help our children," he said. And the collaborative approach benefits researchers, too.

"I'm learning a lot," he said, "because I'm working with people who are very far from my own area of research."