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Creative Cognition in Social Innovation

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Social innovations are creative products and changes that are motivated by social needs and bring value to society by meeting those needs. This article uses case studies to investigate the cognitive and social processes that contribute to creativity in social innovation. The cases are: Wendy Kopp with Teach For America in education, Cicely Saunders with hospices in health care, Mark Zuckerberg with Facebook in technology, Elizabeth Fry with prison reform in social movements, Millard Fuller with Habitat for Humanity in organizations, and Muhammad Yunus with microfinance in finance. These cases illustrate the cognitive processes of combination of mental representations, problem solving, emotion, association, analogy, and method generation. They also illustrate the social processes of emotional communication, support, and conflict.

Creativity operates in many domains, including scientific discovery, technological invention, artistic imagination, and social innovation. There have been many studies on processes of creative cognition, but the studies usually concern scientists, inventors, and artists, rather than social innovators (e.g., Kaufman & Sternberg, 2010; Nersessian, 2008; Simonton, 1988, 2004; Thagard, 1999, 2012, 2014; Ward, Smith, & Vaid, 1997; Weisberg, 1993). In contrast, many studies on social innovation are sociological, rather than psychological (Caulier-Grice, Davies, Patrick, & Norman, 2012; Mulgan, Tucker, Ali, & Sanders, 2007). This article investigates how creativity in social innovation requires cognitive, as well as social, processes, in keeping with Mumford's (2002) definition of social innovation as the generation and implementation of new ideas about people and their interactions within social systems (see also Marcy & Mumford, 2007;

Mumford, Medeiros, & Partlow, 2012; Mumford & Moertl, 2003).

A product is creative if it is new, valuable, and surprising (e.g., Boden, 2004; Kaufman & Sternberg, 2010; Simonton, 2012). A product is a social innovation if it (a) is motivated by social needs and (b) brings value to society by meeting those social needs (Caulier-Grice et al., 2012; Mulgan et al., 2007; Phills, Deiglmeier, & Miller, 2008). If a creative product brings social value but is not motivated by social needs, it can overlap with other domains of creativity, such as technological invention, for example, the invention of X-rays. If a product is motivated by social needs but does not bring social value, it is not creative because it is not valuable.

In the appendix, 50 important social innovations are presented in the following seven categories: education, health care, law and regulation, technology, social movements, organizations and methods for organizing, and finance. Because of lack of information about cases in the law and regulation category, this article focuses on the other six categories. For each of these, the cognitive processes of one social innovator is considered: Wendy Kopp with Teach For America in education, Cicely Saunders with hospices in health care, Mark Zuckerberg with Facebook in technology, Elizabeth Fry with prison reform in social movements, Millard

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Fuller with Habitat for Humanity in organizations, and Muhammad Yunus with microfinance in finance. These examples can be used to evaluate hypotheses about the role of creative cognition in social innovation. People who produce social innovations are sometimes called “social entrepreneurs” (Gunn & Durkin, 2010). For additional discussions of the motivations of social entrepreneurs, see Bargsted, Picon, Salazar, and Rojas (2013) and Germak and Robinson (2013).

The source material employed for each example is autobiographical, meaning that it is either from a social innovator’s autobiography or from an interview, because autobiographical sources provide helpful data about human cognition. The methodology employed in this article is illustrated in the following steps. (a) Create hypotheses based on previous work. (b) Pick an example of social innovation from each of the six categories. (c) Identify as many autobiographical sources in each example as possible. (d) Go through all the sources and extract cognitive processes that contribute to the generation of innovative ideas. (e) Analyze and categorize the cognitive processes. (f) Generalize the categories to evaluate hypotheses.

HYPOTHESES

Based on previous work on creativity, eight hypotheses are proposed about the processes that explain the generation of social innovation (e.g., Boden, 2004; Dunbar and Fugelsang, 2005; Hofstadter, 1995; Holyoak and Thagard, 1995; Kaufman and Sternberg, 2010; Nersessian, 2008; Simonton, 1988, 2004; Thagard, 1988, 1992, 1999, 2012, 2014). These hypotheses are largely derived from Thagard (2014), and were not contrived to fit the six case studies in the following.

- S1. Every social innovation results from a combination of mental representations that can be verbal, visual, or kinesthetic. The most commonly used mental representations include verbal representations gained from other people and visual representations of things similar to the product of innovation.
- S2. Social innovation is generated by a problem-solving process that can include serendipity, which occurs when social innovators find problem solutions that they were not explicitly seeking. Serendipity usually comes from the external world, driven by what innovators see and talk about with other people. Problem-solving usually comes from the internal mental world, driven by what innovators believe should change to make the world better.
- S3. Social innovation is goal-oriented, including both short-term and long-term goals. Driven by external stimuli, a short-term goal concerns tackling a small problem about what needs to be done immediately, whereas long-term goals are concerned with ongoing social problems. Although social innovation aims at achieving goals, the solutions it finds are sometimes serendipitous.
- S4. Social innovation involves both psychological and social mechanisms of emotions. The most common psychological emotions include fear, rage, frustration, hope, and faith, which produce motivation for social innovators to be creative. The most common social mechanisms for communicating emotions include emotional contagion by mimicry, sympathy, social cuing, and power manipulations. The role of emotion in creativity has been discussed by many researchers, e.g., Kaufmann and Vosburg (2002).
- S5. Social innovation usually involves emotional reactions to risk when there is a conflict between emotional responses and deliberate assessments like cost-benefit calculations.
- S6. Social innovation is prompted by two primary cognitive processes: association and analogy. Association is the psychological process that occurs when the activation of some mental representations spreads to the activation of others, which can then be combined into something original (Collins & Loftus, 1975; Schröder & Thagard, 2013). Before a social innovator can combine representations, they must exist in working memory at the same time after being brought to the working memory via association. Analogy is the cognitive process of transferring relational information from one problem to another new one that needs a solution.
- S7. Social innovation is often procedural creativity, where the new product is a method consisting of new rules for doing things.
- S8. Social innovation requires interactions among people that include support, rejection, and reaction to rejection.

How well these hypotheses apply to six important cases of social innovation is examined below.

EDUCATION: TEACH FOR AMERICA BY WENDY KOPP

When Wendy Kopp was a senior at Princeton University in 1989, she proposed the Teach For America program, aimed at eliminating educational inequality by enlisting high-achieving college graduates to teach in low-income communities for at least 2 years. The discussion of Kopp's development of Teach For America is based on her autobiography (Kopp, 2003).

The creation of Teach For America comes from a combination of complex representations: that education failure in low-income communities is due to the lack of good teachers, and that recent graduates would teach in low-income communities. First, Kopp became aware of the failures of the public education system by observing her smart and creative roommate from public school struggling with the academic demands of Princeton University, whereas those who had attended the East Coast preparatory schools thought it was a cakewalk. This representation of education disparity, combined with the verbal representation that low-income communities had difficulty in attracting high-quality teachers, producing the idea that education failure in low-income communities is due to the lack of good teachers. This representation was then combined with the verbal report from student leaders that most of them were willing to teach in low-income communities. The resulting idea is to bring top college graduates to teach in low-income communities, supporting the hypothesis (S1) that creative social innovation involves combinations of representations.

Problem-solving is the main cognitive process that led to Kopp's innovation when she was soul-searching for something meaningful to do after graduation. She was eager to know how to tackle the issue of education failures in public schools, which made her organize a conference to seek solutions to the problem (S2). Kopp's innovation was goal-oriented, with the short-term goal of figuring out her future and what could be done about the failures of public school, and the long-term goal of bringing excellent education to all children in the world (S3).

Both psychological and social mechanisms of emotions contributed to the generation of Teach For America. Kopp experienced many episodes of frustration, including being unable to find anything meaningful to do after graduation, being rejected by all companies she applied to, and having to struggle out of bed at 6:30 AM for fundraising appointments when her fellow students were enjoying postgraduation free time (S4-frustration). Kopp also experienced several kinds of fear, including the worries that her staff members would not listen to her and that she would not get all the 2.5 million dollars she needed in the most

important meeting with Ross Perot (S4-fear). Facing doubts of whether top recent college graduates would want to teach in low-income communities, Kopp maintained hope, because she knew that seniors valued meaningfulness and did not have deep interests in business or finance (S4-hope). Kopp was also motivated by the excitement of independence and by curiosity concerning what would happen next. She said, "I love looking at a calendar and seeing that tomorrow is blank and just deciding what to do with it." (Kopp, 2003, p. 17)

Social mechanisms of emotions also contributed to Kopp's creativity, such as the sympathy Kopp showed to her fellow students who came from public schools and had weak preparation for college. Emotion contagion by mimicry means that people naturally mimic the facial expressions of those with whom they interact, inclining them to acquire similar emotional reactions because emotions are, in part, responses to bodily changes (Hatfield, Cacioppo, & Rapson, 1994). In Kopp's case, emotion contagion by mimicry happened during the spread of enthusiasm about her idea in the conference. Social cuing, described by Giner-Sorolla and Espinosa (2011), means that people's facial expressions can cue negative emotions in their targets in social context of a group, which is exemplified by the sadness Kopp experienced when she got the stimulus of a superintendent being upset and angry at her idea. Power manipulations occur when one person gains power over others by offering them something they desire or by offering to protect them from something that they fear (e.g., Mann, 1986). In Kopp's case, she gained power over Teach For America representatives by offering them something they desire, which was to make a difference in the world (S4-social).

Because she had already recruited school representatives all over the country, the biggest risk Kopp faced was the high probability of not being able to raise the 2.5 million dollars she needed for the first year of her program; this failure would make everything collapse. A professor told her that it was difficult to raise 2,500 dollars, let alone 2.5 million. Other people encouraged Kopp to start locally and then expand, instead of trying to raise so much money all at once. But Kopp used the emotion of hope, rather than cost-benefit calculations, to stay firm about her plan and to finally succeed (S5).

The cognitive process of analogy contributed to the success of Teach For America, because of the inspiration provided by the Peace Corps established in 1961 (S6). The form of analogy in Kopp's case is from something previously successful to something similar that should also happen. Because President Kennedy instituted the Peace Corps, Kopp hoped to create Teach For America under President George Bush. Because the Peace Corps was launched successfully at a large scale, Kopp was convinced that Teach For America

should start as a big movement. In another analogy, Kopp's success in managing 60 staff members and hundreds of thousands of dollars' worth of advertisements and sponsorships in college made her confident that she could pull Teach For America off by herself.

Teach For America introduced a new method to bridge the gap between education in high- and low-income communities consisting of bringing top recent college graduates to teach in low-income communities for 2 years, an alternative to other methods such as raising teachers' salaries and providing high-quality education to teachers (S7). This method can be summarized in the rule: If the goal is to improve education in low-income communities, then get top recent college graduates to teach there.

Kopp has received much support to produce Teach For America: office space from Union Carbide, a seed grant from Mobil, phone and print service from Morgan Stanley, six rental cars from Hertz, and \$2.5 million from Ross Perot, Carnegie Corporation, Kellogg Foundation, and Merck & Company. She also has received a lot of rejection from her professors, company executives, school superintendents, and from most people around her who advised her to start small. In response to rejection, Kopp was determined that her idea was going to work out because she knew what her fellow seniors wanted, and that Teach For America could be a successful movement. Hence Kopp's innovation required both social support and reactions against rejection (S8).

HEALTH CARE: HOSPICE BY CICELY SAUNDERS

Hospice care focuses on both the palliative care of dying people's pain, and on their overall care and emotional needs. One important event in the history of the hospice movement is Cicely Saunders' establishment of St. Christopher's hospice in 1989, after which the hospice movement quickly expanded internationally with its principles such as compassionate care. The discussion of how Saunders came up with the idea of a hospice is primarily based on books (Saunders & Clark, 2005; Saunders, Summers, & Teller, 1981) and on interviews (Stolberg, 1999; Walker, 2012).

The idea of a hospice comes from a combination of representations concerning the need for better pain control and the need for better overall care of the dying (S1). First, the visual representation of dying patients suffering from pain when Saunders worked closely with them, combined with their verbal reports, produced the idea that dying patients needed better pain control. The idea that dying patients needed better overall care came from Saunders' conversation with David Tasma on death and the needs of the dying during his last 2

months. From Tasma's messages, such as "I will be a window in your home" and "I want what is in your mind and in your heart," Saunders felt that the dying desired openness, love, a sense of belonging, and a meaningful life (Saunders, Summers, & Teller, 1981, p. 4). The representation of the need for better pain control combined with the verbal reports of Tasma to produce the idea that better pain control and overall care are both needed in the dying. With a 500 pounds founding gift from Tasma, Saunders went on to study medicine order to serve the dying, before finally establishing her first hospice, St. Christopher.

This innovation resulted from cognitive processes of problem-solving (S2). Once Saunders found out how much her patients experienced, she tried to understand their pain better by asking them to talk about their pain. Once she figured out what the dying people really needed, she went to study medicine to help them and, accordingly, designed her first hospice, St. Christopher. Saunders' hospice innovation was oriented by her short-term goal of figuring out how the dying patients actually felt and what they really needed, and by her long-term goal of establishing her hospice and making the hospice movement global (S3).

Saunders was affected by psychological and social mechanisms of emotions during the generation of the hospice innovation. She was frustrated by the pain suffered by her patients and their deaths; she suffered and was sad when she could not even stay for longer than 2 months with her two most important patients, David Tasma and Antoni Michniewicz (S4-frustration). But because she was also motivated by her Christian faith, along with the founding gift from Tasma and his messages, Saunders went on to study medicine and kept pursuing her mission of palliative care all her life (S4-faith). As for social mechanisms of emotions, Saunders experienced emotional contagion by mimicry of her patients' pain resulting in empathy and sympathy for her patients (S4-social). However, although Saunders did not mention the risks she faced in choosing to quit university and start nursing training, it would have been hard to make such a decision based on cost-benefit calculations rather than emotional reactions (S5).

Analogy and association also contributed to the development of the hospice innovation. Saunders interpreted Tasma's expression "window in your home" as openness to people, to the world, and to each other (Walker, 2012). Such complex metaphors are based on underlying analogies, in this case between homes and minds (Holoak & Thagard, 1995). Saunders interpreted "I want what is in your mind and in your heart" as Tasma's needing skill to gather what looked like an unfulfilled life into a meaningful whole with friendship and love (Saunders, Summers, & Teller, 1981, p. 4). In another analogy, just as philosophy combines love and wisdom, Saunders saw the two

components of a hospice as “the sophisticated science of our treatments and the art of our caring, bringing competence alongside compassion” (Saunders, 1981, p. 4). Association was required to bring ideas into working memory to allow combination. The representation of the need for better pain control was prompted from the visual representation of dying patients suffering and the verbal representation of their descriptions of pain. The representation of the need for better overall care was prompted from the verbal representation of Tasma (Saunders & Clark, 2005; S6).

Hospice introduced a new method of taking care of the dying, which combines “the science of treatments and art of caring with compassion” (Saunders, Summers, & Teller, 1981, p. 4). In a hospice, instead of suffering from pain and loneliness, dying people not only receive palliative care, but also feel love and a sense of belonging. The hospice method can be summarized in the rule: If the goal is to care for dying people, then establish a hospice (S7).

Social interactions were also important for Saunders. Saunders gained support from Tasma’s founding gift to pursue her dream. She had much support later when she made the hospice movement global: When she traveled to the United States, the Dean of the nursing school in Yale, Florence Wald, was inspired by Saunders and established the first American hospice homecare team. The principles and ideas of her first hospice, St. Christopher, were sometimes challenged. People doubted the effectiveness and benefits of her hospice. In replying to the challenges, Saunders kept refining St. Christopher’s politics and gradually earned credibility and recognition worldwide (S8).

TECHNOLOGY: FACEBOOK BY MARK ZUCKERBERG

Facebook, created by Mark Zuckerberg in his Harvard dorm in 2004, is one of the most popular social networking sites, allowing users to connect with their friends and marketers to increase the effectiveness of advertising by accommodating differences among individuals. This discussion on the development of Facebook by Mark Zuckerberg is primarily based on interviews with Zuckerberg (2010a, 2010b) and articles by Campbell (2010), McGirt (2007), Tabak (2004), and a *Harvard Crimson* editorial (“Put online a happy face,” 2003).

The creation of Facebook comes from a combination of two key representations: paper face books (directories) used at Harvard and elsewhere to introduce students to each other, and computer web sites (S1). Zuckerberg created Facemash, a popular web site that asked visitors to judge which Harvard students were “hot.” The visual representation of this web site combined with the verbal representation of an online face

book, which derived from a Harvard *Crimson* statement that a campus-wide online face book is in order, to produce the specific idea of an online face book. This representation then combined with statements by Harvard administrators and the *Crimson* that online privacy was an issue to generate the idea that a campus-wide online face book should address the privacy issue. Hence, the creation of Facebook involved multiple combinations of representations (S1).

Serendipity contributed to the generation of Facebook. Zuckerberg created Facemash angrily after being jilted by a girlfriend, and Facemash allowed him to see the popularity of social sites, suggesting the potential of Facebook. He also accidentally saw the article by a Harvard *Crimson* editor on the need for an online face book, which showed him that such a network had great potential and that privacy was an issue. These inspirations motivated him to use intentional problem-solving to build the online Facebook for Harvard community that addressed privacy issue (S2). Zuckerberg’s short-term goal was to implement the project that created an online version of a student directory. After his Facebook project had gained popularity in other schools, he focused on the long-term goal of bringing value to people by making the world more open and connected. As a result, the innovation of Facebook was goal-oriented (S3).

Zuckerberg had both psychological and social mechanisms of emotions during the generation of Facebook. He was angry when he was jilted, leading him to create Facemash, which in turn catalyzed the creation of Facebook (S4-*rage*). In the fear of losing his reputation from Facemash, Zuckerberg allowed users to take more control of their privacy on Facebook (S4-*fear*). Frustrated by the fact that it would take Harvard a couple of years to create a universal face book, which was what everyone needed at that time, Zuckerberg was confident that he could do it in a week (S4-*frustration*). The emotional social mechanism is contagion by mimicry, which includes the spread of excitement when Zuckerberg and his friends were talking about biggest trends in the world, and the spread of frustration when Harvard kept postponing the creation of a universal face book (S4-*social*).

Emotional reactions, rather than deliberate cost-benefit assessments, were involved in decision-making when Zuckerberg was facing risks. After Facebook showed great success at Harvard, deliberate cost-benefit assessment might have suggested launching it at schools with the highest potential benefits because of lack of competition. In contrast, Zuckerberg launched Facebook in schools where social networks already existed. He was not driven by the goal of building a company or cashing in, but rather by his emotional curiosity to see how great his project could be (S5).

The generation of Facebook also involved the cognitive process of analogy. The form of analogy in Zuckerberg's case is from something previously successful to something similar that should also happen. Because the social site Facemash was very popular, Zuckerberg thought that Facebook would be as popular. Also, Zuckerberg's online web site was based, in part, on existing paper directories used in his high school and Harvard's dorms (S6).

Facebook introduced a new method of staying open and connected with friends and, at the same time, taking control of privacy. It means that when people want to connect with their friends, instead of calling or e-mailing them, they can also go online and visit their friends' Facebook pages (S7). This method can be represented by the rule: If your goal is to make social connections, then use Facebook.

Social interactions were also important to Zuckerberg. He gained support from his rich fellow student, Eduardo Saverin, for paying for the server; from his roommates, Dustin Moskovitz and Chris Hughes, for joining the Facebook founding team; from his high school friend Adam D'Angelo for helping to set up databases; and from Peter Thiel for being his first angel investor. Later resistance included the lawsuit of the Winklevoss twins and pressure to sell Facebook, which did not happen because Zuckerberg was interested in bringing value to people, instead of cashing in (S8).

SOCIAL MOVEMENTS: PRISON REFORM BY ELIZABETH FRY

Elizabeth Fry is one of the leading reformers who made the treatment of prisoners, especially female ones, more humane. Horrified by the bad living condition in the Newgate prison, Fry started working closely with the prisoners, bringing them clothes, schooling, industry, and a voting system for rules. This discussion of Fry's work with prisoners is primarily based on Fry (1847) and Lewis (1909).

The creation of prison reform comes from combinations of representations of prisoners, school, clothing industry, rules, and democratic rights (S1). First, the visual representation of prisoners' overcrowded and dirty living conditions and their insufficient clothing combined with representation of the clothing industry outside prison to produce the idea that a clothing industry could be run by prisoners: Prisoners could use sewing and knitting to create clothes for their use and also for sale. Second, the verbal representation of what the prisoners told Fry about their needs combined with representation of school systems outside prison to inspire Fry to establish a school in prison. Third, the visual, verbal, and kinesthetic representation of prisoners' ferocious manners and fights combined with the concept

of democratic rights to produce the idea of using democratic rights to generate rules that control prisoners' behavior. The final idea is to improve living condition of prisoners by introducing industry, opening a school, and establishing voting for rules in prison.

The innovation of prison reforms involved intentional problem-solving processes. It was accidental that Fry visited the Newgate prison with her friend Stephen Grellet; but after Fry saw the horrible environment in prison, she used intentional problem-solving to come up with ways to improve prisoners' living conditions (S2). She not only talked to prisoners about their needs, but also applied knowledge of what was working outside prison. Initially, Fry and her friends donated to prisons clothes they made to solve the problem of insufficient clothing. But regarding the long term, Fry aimed to create a sense of self-respect and independence among prisoners using the concepts of industry and democratic rights. Thus, the creation of prison reform was goal-oriented (S3).

Both psychological and social mechanisms of emotions contributed to the creation of prison reform. Fearing that her life would slip away to little purpose due to the demands of motherhood, Fry was motivated to do something meaningful (S4-fear). The frustration Fry had when she visited the Newgate prison motivated her to help the prisoners. Fry was also frustrated when she had to agree with men in authority in order to obtain their support, when she visited women before their execution, and when Lord Sidmouth did not approve her plea to end capital punishment (S4-frustration). But she always had faith in God, which made her believe that she was doing the right thing (S4-faith). Socially, Fry showed sympathy to the prisoners for their horrible living conditions. She was affected by emotional contagion from the prisoners' distraught and tormented minds before their executions and by their tears of joy after she helped them. When Fry read Scriptures to the prisoners, some of them feared that their day of salvation had passed, a case of social cuing in which one person's emotion leads to different emotions in others (S4-social).

Fry faced the risk that all her efforts might be in vain if prisoners did not appreciate her kindness of trying to improve their living conditions. Using deliberate cost-benefit assessments, one might lose hope in prisoners due to their untrained and perturbed spirits, but because Fry got emotionally attached to most prisoners and had faith in God, she was determined to keep doing her work regardless of objections from others (S5).

The cognitive processes of association and analogy contributed to prison reform (S6). Association helped to form the idea of a clothing industry run by prisoners as the result of Fry's visual representation of the insufficient clothing of female prisoners and their children. Analogy also contributed to the success of the

prison reform when Fry projected the success of industry and democracy in society onto prisons. As a result, Fry taught the prisoners sewing and knitting, and gave them rights to vote for the rules that applied in their own communities.

Fry introduced new methods of treating prisoners (S7). Prisoners gained self-respect by voting rules for themselves, and they became independent by learning to sew and knit so that they could provide themselves with sufficient clothing and generate income by selling those goods. The new methods made the treatment of prisoners more humane. Fry's new methods can be illustrated by the rule: If the goal is to improve the condition of prisoners, then establish a clothing industry and democratic procedures.

The innovation of prison reform also involved social interactions with people who supported and opposed Fry. Her views on improving prison conditions were received with cordial approbation by Sheriffs of London and the Governor of Newgate. Those in power were finally willing to help her after being against it. However, some city magistrates told Fry that what she was doing was in vain; Lord Sidmouth disapproved of Fry's plea to end capital punishment for theft, and officers of the Newgate prison thought that introducing industry into prison would finally fail. Despite all the oppositions, Fry had strong religious faith that motivated her to continue her experiments (S8).

ORGANIZATIONS: HABITAT FOR HUMANITY BY MILLARD AND LINDA FULLER

Habitat for Humanity, founded by Millard and Linda Fuller in 1976, is a nongovernmental organization that brings volunteers together with poor people to build decent and simple houses for them in many countries. The following discussion on the creation of the Habitat for Humanity is based primarily on writings by Millard Fuller (1977, 2010; Fuller & Scott, 1986).

The creation of Habitat for Humanity came from combining representations of homeless people and partnership to form the idea of partnership housing for the homeless. First, the visual representations of the urban ghetto and frustrated poor people combined with the verbal representation of partnership arising from a conversation with Clarence Jordan, Fuller's long time mentor. This combination led to the idea that the poor needed to regain their identity with God via "a spirit of partnership" (Fuller, 1977, p. 18). Second, the concept of "a spirit of partnership" combined with the visual representation of the homeless to form partnership housing for the homeless (S1).

Intentional problem-solving, rather than serendipity, contributed to the creation of Habitat for Humanity.

Before Fuller went back to Koinonia, he became less enthusiastic about his work at Tougaloo College and pondered his next move. After he got back to Koinonia, he worked together with Jordan and a few other people to come up with ways to help the poor nurture a new spirit of partnership, which included the partnership housing project. Fuller also used intentional problem-solving when he was trying to come up with a solution for the deterioration of Koinonia (S2). Fuller's short-term goal was to find ways to nurture a spirit of partnership to help the poor regain relationship with God, and his long-term goal was to improve housing conditions of the poor all over the world (S3).

Both social and psychological mechanisms of emotion contributed to the creation and implementation of Habitat for Humanity. Fuller showed sympathy to the poor when he saw them living in shacks, and to others in Africa who were in poor health or died. The spread of the excitement of the partnership housing idea among the Koinonia group, and the excitement of housing building among the poor, shows that emotional contagion by mimicry was involved. The innovation of Habitat for Humanity also involved attachment-based learning as another social mechanism of emotion, which happens to people when the emotional expression by people they care about makes them more likely to have those emotions, as well (Minsky, 2006). In Fuller's case, attachment-based learning happened when Fuller's friend Jordan nurtured him back to emotional and spiritual health, because seeing Jordan talk about his faith made Fuller become more religious (S4-social).

Psychological mechanisms of emotions were also important. When Fuller was expanding Habitat for Humanity to Africa, he became depressed when he realized the enormous challenges he was facing, including having no idea on where to start from huge failures of the Block and Sand Project (S4-frustration). Fuller got angry when thieves stole tools needed for construction, and when city government interfered with his construction, asking for building permits (S4-rage). Although Fuller experienced frustration and rage, he focused on great opportunities and fascinating people around him, because he thought that God brought him this rich experience of serving Him (S4-faith).

When Fuller was in Africa, he faced the risk of "tropical bugs and diseases, lengthy family separations, different culture adjustments, and struggles with unfamiliar languages," plus the misunderstanding of his landlord and the resistance from city government, which he did not expect (Fuller, 1977, p. 44). By using deliberate cost-benefit assessments, people in his situation might not choose going, due to the tremendous amount of risk of traveling to Africa. But because Fuller had deep religious faith and was passionate about spreading his housing project to another place, he decided to go (S5).

Cognitive processes, such as association and analogy, also contributed to the implementation of the idea of partnership housing. First, the representation that Africa might also need partnership housing arose from the visual representation of the Block and Sand Project in Africa, leading to the Fuller family's settlement in Africa. Second, the determination for Fuller to choose a piece of land arose from the verbal representation of Dr. Bokeleale that the land had not developed because it was a dividing section between the Blacks and Whites in colonial days. This verbal representation generated the inference that it would be a "significant and symbolic" act for choosing this land in the name of Christ to bring people together (Fuller, 1977, p. 70). Analogy was also used by Fuller. Having had a successful cookbook business when he was a businessman, Fuller addressed his concern about the deterioration of Koinonia by promoting the Koinonia Pecan Cookbook. Analogous to the success of the Habitat project in Georgia, Fuller thought that it should also work in Africa, and then also in San Antonio (S6).

Habitat for Humanity created a new method of helping the homeless and the poor get housing by building their own houses through partnership. Instead of asking government to spend more money to build decent houses for the homeless, Habitat for Humanity got the homeless and volunteers to form teams to build new houses for poor people. This novel method can be represented by the rule: If the goal is to improve housing for the poor and homeless, organize them into partnerships for building their own homes (S7).

Social support was important for Fuller, especially from his long-time mentor, Jordan. Other supporters included Bob Nelson, the African Secretary for the Christian Church, who connected Fuller with existing housing project in Africa, and David Stowe, the Executive Vice President of the United Church Board for World Ministries, who provided Fuller grant for his housing project. Social resistance included city government, who asked for a ridiculous \$50,000 building permit, and African builders who failed to show up for work because they felt no connection to what they were building. To overcome social resistance, Fuller started construction anyway and ignored the housing permit, which was never mentioned by the city government again. Fuller also talked to African builders repeatedly with the goal of helping them take pride in their efforts (S8).

FINANCE: MICROFINANCE BY MUHAMMAD YUNUS

Muhammad Yunus won the Nobel Peace Prize in 2006 for his contribution to the development of microfinance. He founded Grameen Bank, a Bangladesh bank that

gives small loans to the poor who cannot get loans from traditional banks. This discussion on the generation of the microfinance idea by Yunus is based primarily on Yunus' (2003) autobiography and an interview (Yunus, 2009).

The creation of the idea of microfinance comes from combinations of representations of the poor, money, loans, and banks (S1). Yunus' visual representations of the poor and starving people in the street showed that his theories of economics did not work. A new solution for poverty was needed, which led him to visit Jabro village to figure out how to help the poor. The visual contrast there between the beautiful handicrafts that village women made and their old clothes and houses generated the conclusion that what the poor needed was just a small amount of money. The representation of a small amount of money that the poor needed combined with the idea of a loan, producing the idea to give loans to the poor. Finally, this representation of giving loans to the poor combined with the representation of banks, creating the idea of microfinance: a bank that gives small loans to the poor to alleviate poverty.

The generation of the idea of microfinance resulted from a problem-solving process in which Yunus visited Jobra village to talk to poor people and understand their needs (S2). Yunus' initial goal was to figure out what drove famine, and his long-term goal was to revolutionize the banking industry to make banks aware that the poor are credit-worthy and needed help, so the creation of microfinance was also goal-oriented (S3).

Yunus had both psychological and social mechanisms of emotions in the process of coming up with the microfinance idea. He was in a rage when Sufia in Jobra village made beautiful bamboo stools but could only make two cents per day due to the greed of her trader. He later recalled, "I was angry at myself, angry at the world which was so uncaring" (Yunus & Jolis, 2003, p. 7). Yunus also felt terrible that his economics theories did not work in saving the dying people: "What good were all these elegant theories when people died of starvation on pavements and on doorsteps?" (Yunus & Jolis, 2003, p. 3; S4-rage). When banks rejected the idea of giving loans to the poor because they were not credit-worthy, Yunus had deep faith in the poor and decided to prove it by becoming a guarantor for them (S4-hope). Socially, at the very beginning, Yunus showed sympathy to the poor for not being able to sell their crafts in free market. Yunus was deeply affected by the women's emotions via emotional contagion by mimicry, which motivated him to continue his work: After the creation of the Grameen Bank, many women cried after receiving money and hugged Yunus to thank him, which was unusual behavior between a woman and a nonrelated man in Bangladesh. Power manipulations were also used by Yunus: Yunus gained emotional power over the poor by offering them

the money they desired and protecting them from what their fear of becoming slaves of traders (S4-social).

Yunus faced the risk that the poor would not return the money, as traditional banks told him would happen. If he had used deliberate cost-benefit assessments, he might have concluded that poor people were not credit-worthy, as banks told him. But Yunus' emotional reactions to Jobra women who suffered from usury led him to take the risk and become their guarantor. Later, he even took more risks, such as not looking at people's credit history when lending them money. He had deep faith that "it's not people who aren't credit-worthy; it's banks that aren't people-worthy" (Yunus & Jolis, 2003, p. 1), basing his actions more on emotions than on deliberate cost-benefit assessments (S5).

Analogy contributed to the generation of the microfinance idea when Yunus thought that loans could be given to the poor, much like loans given to the privileged. Metaphorically, he said that people should take a worm's view of economic problems rather than a bird's view. He thought that traditional theories of economics only give people a large-scale bird's perspective, whereas with worm's perspective, they can look at things at close range and sharply and make fewer mistakes. Association also led to the generation of microfinance: The concept of money activated the concept of loans, which further activated the concept of bank, when Yunus was looking for a solution to provide a small amount of money to the poor (S6).

Yunus introduced a new method of relieving poverty, giving small loans to the poor rather than just providing charity (S7). Giving loans to the poor is more beneficial to society than donations because money is returned and the poor can gain the skills for making a good living. The new method of microfinance enhances the credibility of the poor by constructing five-person groups with communication sessions and asking them to stick to a set of specific rules. The new method can be expressed by the rule: If the goal is to improve the conditions of poor people, then give them small loans to set up businesses.

Social interactions also played a vital role for Yunus (S8). Yunus gained support from his family and from people who accompanied him during his visit to Jobra village. Supporters included a professor who knew most of the families there, and Yunus' female students who spoke for him when he could not talk to women face-to-face under Muslim tradition. Many other people objected to Yunus' efforts. His colleagues thought that it was degrading for a professor to talk to the poor; banks were unwilling to give loans to the poor, and husbands of the women who got loans from Yunus felt insulted. Yunus ignored what his colleagues said, became a guarantor for the poor, started a bank himself after finding banks hard to work with, and tried to help

men realize that women's financial income could share their financial burden.

DISCUSSION

The six examples of social innovation all confirm hypotheses S1–S8: Combinations, problem-solving, goals, emotions, analogy or association, risk, and social interaction all contribute to the generation of social innovations. Further historical research is needed to determine whether these hypotheses also apply to 44 other examples of social innovation that are listed in the appendix. The six case studies herein are only illustrations of the plausibility of the eight hypotheses, not a demonstration of their truth. A more rigorous test of the hypotheses would: (a) consider a much larger set of cases, such as those listed in the appendix; (b) look for sources of information that corroborate sometimes unreliable autobiographical reports; (c) use a precise coding method to analyze cases; and (d) examine a comparison group of unsuccessful social innovations. Nevertheless, these six cases provide evidence that the hypotheses are worth considering as part of the cognitive explanation of creativity in social innovation. The inferences made about creators' internal mental processes are obviously not directly derived from their behavior, but can be inferred if they are part of the best explanation of that behavior, in accord with standard practice in cognitive psychology.

In addition to the psychological and social emotions, such as anger and sympathy, a sense of moral duty and a sense of moral satisfaction might also have contributed to the six social innovations. Although the social innovators did not mention them explicitly, these moral emotions should provide motivation to improve people's lives instead of pursuing normal careers.

Generally, the process of social innovation starts with goals that initiate intentional problem solving that leads to solutions by means of reasoning, association, analogy, and conceptual combination. The creation of Facebook was an exception because the solution preceded goal-driven problem solving: Zuckerberg combined the ideas of a student directory and a web site to produce what turned out later to be a solution to problems concerning human interactions and privacy. In this respect, Facebook was like a small minority of technologies, such as anesthetics, antibiotic molds, and lasers, where the solution preceded the problem.

This investigation naturally raises the question of whether the cognitive and social processes of social innovation are similar to, or different from, the processes that operate in other domains of creativity such as scientific discovery, technological invention, and artistic imagination. The eight hypotheses also apply

well in those domains, suggesting that social innovation is fundamentally like other kinds of creativity, but there are subtle differences. First, social innovations are often inspired by visual and verbal representations of people in need, in particular images of poor, dying, and unhappy people that motivate innovators to try to understand and lessen suffering. Although creativity of scientists, inventors, and artists can also be inspired by concerns about humans, these innovators have less communication with their targets than occurs in social innovation. Second, social innovations all involve social mechanisms of emotions, including emotional contagion by mimicry, sympathy, social cuing, and power manipulations, whereas other domains of creativity may rely more on the emotions of the individual creators. Not surprisingly, social innovation seems to be more social than other kinds of creativity, although all of these are far from being purely individual processes.

Most of the creative cognitive processes in the six cases have been investigated with detailed computational models, including combination of representations, goal-directed problem-solving, analogy, association, and emotion. But the cases identify a major gap in cognitive modeling of creativity, because none of the known algorithms for generating rules seem adequate for producing the methods that are described in each of the cases. The generation of methods is also an important part of creativity in science (e.g., controlled experiments), technology (e.g., computer programming), and art (e.g., impressionist painting). The generation of new methods can be called *procedural creativity*, because it requires the production of new procedures rather than the concepts, hypotheses, or things that are usually considered as creative products. The generation of new methods often uses the following steps. (a) Start with goals that indicate a specific problem to be solved. (b) Try to solve the problem by processes such as reasoning, association, analogy, and combining representations. (c) Arrive at a specific solution to the specific problem. (d) Generalize the successful problem solution into a method of the form: If the goal is to solve a problem of this type, then use a solution of the type discovered. Future work is needed to develop detailed accounts of the cognitive mechanisms for this kind of procedural creativity. It is important to note that procedural creativity is much broader than process innovation in business, which involves the implementation of new kinds of production and delivery (Davenport, 1993). Concerned with meeting social needs, the goals of social innovations are typically very different from the profit-oriented concerns of businesses.

Despite this gap, this article has contributed to the understanding of social innovation by identifying cognitive and social processes that operate in six important cases in education, health, technology, social

movements, organizations, and finance. Kopp's Teach For America, Saunders' hospices, Zuckerberg's Facebook, Fry's prison reforms, Fuller's Habitat for Humanity, and Yunus's microfinance all displayed rich creative pathways. Hence, social innovation is a fertile domain for creativity research.

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APPENDIX: 50 IMPORTANT SOCIAL INNOVATIONS

Note: The short introductions are based on entries in Wikipedia. No ranking of the relative importance of the innovations is intended.

Education

1 Innovative educational approaches – Waldorf and Montessori Education

Waldorf education was developed by an Austrian philosopher and emphasized the role of the imagination in learning and the value of integrating academic, practical, and artistic pursuits. Montessori education was developed by an Italian educator and emphasized freedom within limits and respect for a child's natural psychological development.

2 Standardized Test/Meritocracy

The earliest evidence of standardized testing was in China's Imperial examinations. SAT (implemented by Henry Chauncey) is one of the standardized tests for entrance to college, reflecting American meritocracy.

3 Distance Learning

The University of London was the first university to offer distance learning degrees in 1858. The Open University was founded on the belief that communications technology such as radio could bring high quality degree-level learning to people who had not had the opportunity to attend traditional universities.

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4 Online Learning Platforms – Khan Academy

Khan Academy is a non-profit educational website created in 2006 by American educator Salman Khan. The stated mission is “providing a high quality education for anyone, anywhere.” The website supplies a free online collection of more than 4,000 micro lectures via video tutorials in more than 15 subjects.

5 Encyclopedia/Wikipedia

The first known encyclopedia was from the European Middle Ages, and the method was developed by Diderot and others. Wikipedia was launched by Jimmy Wales and Larry Sanger in 2001 as an online free encyclopedia, but the concept of an open source online encyclopedia was first proposed by Richard Stallman in 1999.

6 Teach for America (USA)/Teach First (UK)/Teach for All (global)

Their mission is to eliminate educational inequity by enlisting high-achieving recent college graduates and professionals to teach in low-income communities in 2-year commitments. Teach For All is an international non-profit that aims to adapt the model to many countries contexts and affects 800,000 students all over the globe.

7 Charter school

Charter schools are primary or secondary schools that receive public money, have more flexibility than traditional public schools, and are attended by choice. The idea was originated by Ray Budde, a professor in the US, hoping to reform the public schools by introducing autonomous public with accountability for student achievement.

8 Kindergarten

The idea of kindergarten originated from Friedrich Froebel’s vision around 1850 of creating a special place in which small children were removed from parental influences and learnt to enjoy learning through playful activities. By 1870s the model spread throughout Western Europe and the US, and by 1910s, kindergartens were everywhere.

Health Care**9 Bismarck Model of health care**

German Chancellor Otto von Bismarck invented a health care model that is widely used in Germany, France, Japan, etc. Health care is a regulated enterprise where the providers, payers, and insurance plans are private.

10 Nursing

Florence Nightingale is the founder of modern nursing. Her most famous contribution came during the Crimean War, where she raised funds for supplies, and reduced death rate of soldiers from 43% to 2%. After war, she used statistical methods to improve health in British army, established medical school to improve sanitary condition, and revolutionized the theory of hospital construction.

11 Hospice

Hospice care focuses on the palliative care of patients’ pain and attends their emotional needs. A dying Polish refugee helped solidify Cicerly Saunders’ ideas that terminally ill patients needed compassionate care. She became a physician who emphasized focusing on the patient rather than disease. She disseminated her theories and developed hospices internationally.

12 Universal health care

Universal health care refers to a national health care system that provides health care and financial protection to all its citizens. The goal is to provide financial risk protection, improved access to health services, and improved health outcomes.

Law and Regulation**13 Patent law**

The concept of a patent was first introduced in Greece and Italy. Patent law originated in 1474 when the Republic of Venice enacted a decree that invented devices had to be communicated to the Republic to secure rights. Then countries such as England, America, and France also established patent law.

14 Restorative justice

Restorative justice focuses on the needs of victims and offenders as well as the community, and provides help for offenders in order to avoid future offences. This approach dates back to 2060 BC, and continues to be practiced, e.g., in South Africa’s Truth and Reconciliation Commission.

15 Affirmative action

Affirmative Action refers to policies that take factors such as race, color, religion, sex, or national origin into consideration in order to benefit an underrepresented group in areas of employment, education, and business.

16 Congestion charge

To reduce traffic congestion, surcharges can be levied on users of public goods that are subject to congestion through excess demand, such as bus services and railways. William Vickrey first proposed congestion pricing for the New York City Subway system in 1952.

17 Emissions trading

A market-based approach can be used to control pollution by providing economic incentives. Government sets emissions permits (CO₂) and allows the trading the permits. It started from computer simulation studies in the US in 1970 and became law in 1990, dropping acid rain emissions by 3 million tons that year.

18 Disability rights in India

After almost a half century of independence, India’s disabled population enjoyed no protections and received no consideration in government decision-making. Javed Abidi, himself disabled, established India’s first-ever civil rights legislation for people with disabilities.

19 Same-sex marriage

Same-sex marriage is marriage between two people of the same gender. The first laws enabling same-sex marriage were enacted during the first decade of the 21st century, starting in the Netherlands in 2001. As of May 2013, 13 countries and several sub-national jurisdictions allow same-sex marriage.

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Technology**20 Facebook**

Facebook is an online social networking service founded in 2004 by Mark Zuckerberg. Users can create a personal profile, add other users as friends, post items, exchange messages, etc.

21 Internet

The Internet began when a message was sent over the ARPANet from UCLA to SRI in 1969. Access to the ARPANet was expanded in late 80s and finally commercialized in 1995. The Internet made possible many social innovations, including email, websites, online shopping, crowdsourcing, etc.

22 Email

Email is a method of exchanging digital messages from an author to one or more recipients. The first email system was MIT's Compatible Time-Sharing System in 1961. Today's email systems are based on a store-and-forward model, in which neither the users nor their computers are required to be online simultaneously.

23 Printing

Johannes Gutenberg's invention of mechanical movable typeprinting started the Printing Revolution that played a key role in the development of the Renaissance, Reformation, Enlightenment, and the Scientific Revolution, and laid the material basis for the modern knowledge-based economy and the spread of learning to the masses.

24 Telephone

First patented in 1876 by Alexander Graham Bell and further developed by many others, the telephone was the first device in history that enabled people to talk directly with each other across large distances. Telephones became rapidly indispensable to businesses, government, and households, and are today some of the most widely used small appliances.

Social Movements**25 Fair trade**

Fair trade seeks to alleviate poverty by enabling poor producers to use the free market to their advantage. The main actors are producers located in impoverished countries, organizations that trade, and customers who recognize those products and buy them.

Edna Ruth Byler was one of the pioneers with fair trade linen needlework for women in Puerto Rico in the 1940s.

26 Cooperative movement

Robert Owen began the first co-operative store in the cotton mills of New Lanark to put workers in a good environment with access to education for themselves and their children, growing their own food and ultimately becoming self-governing.

27 Protestant Reformation

The efforts of reformers such as Martin Luther who objected to the doctrines, rituals, and ecclesiastical structure of the Roman Catholic Church led to the creation of new national Protestant churches.

28 Abolitionist movement

A movement to end the African slave trade and set slaves free, abolitionism started in Spain and England in the 16th century. Frederick Douglass was a leader of abolitionism in the US, after escaping from slavery.

29 Leninism/ vanguard party

Leninism added to Marxism the notion of a vanguard party to lead the proletarian revolution and to secure all political power after the revolution for the working class.

30 Civil rights movement

Civil rights movements are activities in many countries for legal equality. In the US, the leading figures for racial equality included Martin Luther King Jr., Medgar Evers, and Jesse Jackson.

31 Environmentalism

The first large-scale environmental laws were the British Alkali Acts to regulate air pollution. In the US the movement was influenced by Henry David Thoreau and Rachel Carson.

32 Feminism

Feminism defends equal rights for women. The first wave was suffrage movements of the nineteenth and early twentieth centuries, promoting women's right to vote. The second wave campaigned for legal and social equality for women in the 1960s. The third wave in the 1990s placed more emphasis on race and culture.

33 Non-violent civil disobedience

Civil disobedience is the professed refusal to obey certain laws and commands of a government. Thoreau's essay "Civil Disobedience" had a wide influence on many later practitioners of civil disobedience. Mahatma Gandhi employed new techniques of non-violent civil disobedience that he developed to lead India to independence.

34 Settlement movement

The goal of the settlement movement was to get the rich and the poor to live more closely together in an interdependent community. Settlement houses were established in poor areas, and allowed middle-class settlement workers to alleviate poverty in low-income communities.

35 Reformation of female prisoners

Elizabeth Fry visited Newgate prison and was horrified by the bad living condition of the women's section. She stayed in the prisons with them and invited nobility to see the conditions prisoners lived in. She then found a prison school for children who were imprisoned with their parents and began a system of supervision by requiring women to sew and read the Bible.

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36 **Open-source movement**

Some computer programmers and users support the use of open source licenses for some or all software. Open source software has source code available for anybody to use or modify. The roots of the movement are the MIT AI lab on the east coast and the Computer Science Research Group of UC-Berkeley on the west coast.

37 **Slow food movement**

Slow food is an international movement founded by Carlo Petrini in 1986, striving to preserve traditional and regional cuisine and encourage farming of plants and livestock characteristic of the local ecosystem as an alternative to fast food. The movement has since expanded globally to over 100,000 members in 150 countries

Organizations and Methods of Organizing38 **Business incubators**

Incubators support the development of entrepreneurial companies through an array of business resources and services, developed and orchestrated by incubator management. They began in the USA in 1959 when Joseph Mancuso opened the Batavia Industrial Center in Batavia, New York.

39 **Think tank**

These organizations perform research and advocacy concerning topics such as social policy, political strategy, economics, military, technology, and culture. Such organizations date to the 19th century, but the term originated in the 1950s primarily in the US, and then spread to other parts of the world in the 1980s.

40 **Habitat for Humanity (Millard and Linda Fuller)**

Habitat is an international, non-governmental, and non-profit organization founded in 1976 by Millard and Linda Fuller, aiming to build simple, decent, and affordable housing using volunteer labor and to address the issues of poverty housing all over the world. Habitat has helped build more than 600,000 houses and served more than 3 million people around the world.

41 **Assembly line**

An assembly line is a manufacturing process in which parts are added to a product in a sequential manner much faster than with handcrafted methods. The division of labor was discussed by Adam Smith in his book *The Wealth of Nations*.

42 **Census**

A census is the procedure of systematically acquiring and recording information about the members of a given population. A census usually represents a national population, but there are also agriculture, business, and traffic censuses. Censuses can be dated back to Egypt's early Pharaonic period in 3340 BCE.

43 **Community organizing**

The goal of community organizing is to generate durable power for an organization representing the community, allowing it to influence key decision-makers on a range of issues over time. Saul Alinsky was the first person in America to codify key strategies and aims of community organizing.

44 **Scientific management**

Scientific management, developed by Fredrick Winslow Taylor, reconceptualized work in terms of optimal, repeatable procedures that maximize economic efficiency and labor productivity.

Finance45 **Microcredit/microfinance-Grameen Bank (Muhammad Yunus)**

Muhammad Yunus developed the concepts of microcredit and microfinance, and founded Grameen Bank, a Bangladesh bank that gives loans to entrepreneurs, mostly women, too poor to qualify for traditional bank loans.

46 **Banking**

Banking in the modern sense can be traced to medieval and early Renaissance Italy, to a number of banking dynasties: Medici, Fugger, Welser, Berenberg, Baring and Rothschild.

47 **Insurance**

Insurance is a modern business against risks regarding ships, cargo, buildings, death, automobile accidents, and medical treatment. First practiced by Chinese and Babylonian traders, Persian monarchs made it official in government, and the Greeks and Romans introduced health and life insurance.

48 **Taxation**

Taxation systems date back to Ancient Egypt, and income tax was introduced in Britain in 1799 to pay for weapons and equipment in preparation for the Napoleonic wars.

49 **Pensions**

A pension is a contract for a fixed sum to be paid regularly to a person, typically following retirement. Types of pensions include employment-based pensions, social and state pensions, and disability pensions. Widows' funds were among the first pension type arrangement to appear in 1645.

50 **Stock Market**

The concept of stock dates back to ancient Rome, and spread to other mercantile cities of Europe in 16th century. In 1602, the Dutch East India Company was formed as a joint-stock company based in six locations with shares that were readily tradable.