

Contents

1. Introduction	1
1.1. Our Proposal	2
1.2. Methodology Outline	2
1.3. Contributions	4
1.4. Scope and Limitations	4
1.5. Thesis Outline	5
1.6. Other Contributions	5
1.7. Related Publications	6
2. Live Programming	9
2.1. Introduction to Live Programming	9
2.2. What is Live Programming	10
2.3. Current Practices in Addressing Live Programming	11
2.4. Live Programming in Pharo	13
2.4.1. Source Code Navigation	14
2.4.2. Runtime Exploration	15
2.5. Summary	17
3. Live Programming and Software Evolution	18
3.1. Introduction	18
3.2. Background and Related Work	20
3.2.1. The Studies by Sillito <i>et al.</i>	20
3.2.2. Studies on Developer Information Needs	22
3.3. Research Method	25
3.4. Results: Developer Questions	29
3.4.1. Finding Focus Points (FFP)	30
3.4.2. Expanding Focus Points (EFP)	31
3.4.3. Understanding a Subgraph (US)	31
3.4.4. Questions over Groups of Subgraphs (QGS)	31
3.4.5. Additional Questions	32
3.5. Results: Developer Question Complexity	33
3.6. Results: Tool Usage Answering Questions	36
3.7. Results: Tool Support Answering Questions	38
3.8. Discussion: Dynamic Information	40
3.9. Threats to Validity	41
3.10. Summary and Implications	42

4. The Road to Live Programming: Insights From the Practice	44
4.1. Introduction	44
4.2. Research Method	46
4.2.1. Exploratory Study	46
4.2.2. On-line Survey	46
4.2.3. On-line Coding Session Videos	47
4.3. Results: Usage of Liveness	47
4.4. Results: Liveness Episodes	49
4.4.1. Accessing and Manipulating Objects	50
4.4.2. Finding, Modifying, and Executing Examples	51
4.4.3. Crafting Code Snippets	52
4.4.4. Modifying Running Applications	52
4.4.5. Traditional Approaches	53
4.4.6. Combining Approaches	54
4.5. Results: On-line Survey	55
4.6. Results: On-line Coding Sessions	57
4.7. Findings and Discussion	58
4.7.1. On Liveness	58
4.7.2. On Tool Support	60
4.8. Threats to Validity	62
4.9. Summary and Implications	63
5. Electronic Developer Communication	65
5.1. Introduction	65
5.2. Live Communication	66
5.3. Communication Media	69
5.4. Real-time Collaboration	72
5.5. Summary	73
6. Sending Software Artifacts From the IDE to the Chat with LightShare	75
6.1. Introduction	75
6.2. LightShare	77
6.2.1. Motivating Example	77
6.2.2. How LightShare Works	78
6.2.3. LightShare Pre-Study Survey	79
6.3. Research Method	81
6.3.1. Study Decisions	82
6.3.2. Study Design	82
6.3.3. Analysis	84
6.3.4. Limitations of the Study	85
6.4. Results and Findings	86
6.4.1. Participant Activity	86
6.4.2. Message Content	88
6.4.3. Comparison with Discord Sharing	90
6.4.4. Usage Scenarios	91
6.5. Feedback and Discussion	97
6.5.1. On Sharing Artifacts	98

6.5.2. On the Level of Integration	101
6.6. Personal Reflections	104
6.7. Summary And Implications	105
7. Conclusions	107
7.1. Dissertation Contributions	107
7.2. Live Programming Impact	109
7.3. Future Work	112
Bibliography	121