Koreferenz und Anaphorik in einer Programmiersprache: Beispiele, Aussichten und Probleme

Sebastian Lohmeier
sl@monochromata.de

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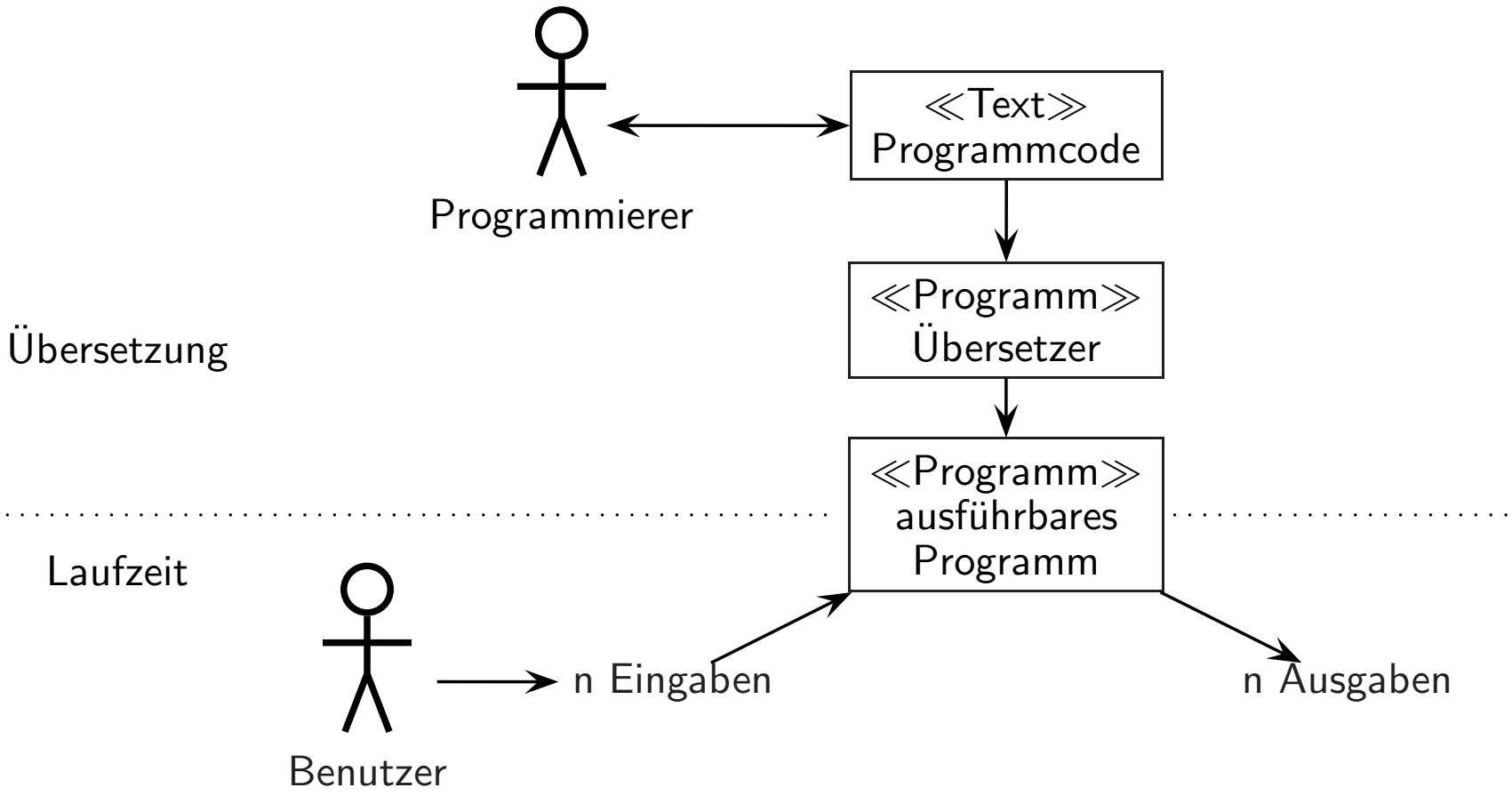
Übersicht

Programmierumgebung



Beispielprogramm

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {









}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Beispielprogramm

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
```

```
  return run;
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new WashingMachine().wash(
  new Clothes(new Description("my socks")),
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Beispielprogramm

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
  MachineListener
     listener=user.getListener();
  setListener(listener);




  removeListener(listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
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Beispielprogramm

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
  MachineListener
     listener=user.getListener();
  setListener(listener);
  start(run, clothes.getDescription());
  wash(run);
  spinDry(run);
  finish(run, clothes.getDescription());
  removeListener(listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
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```

Beispielausgabe

```
start(run, clothes.getDescription());
wash(run);
spinDry(run);
finish(run, clothes.getDescription());

Run 1: started washing my socks
Run 1: washing
Run 1: spinning dry
Run 1: finished washing my socks
```

Referenz im Beispielprogramm: Variablen

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
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     listener=user.getListener();
  setListener(listener);
  start(run, clothes.getDescription());
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Direkte Anaphern

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
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     listener=user.getListener();
  setListener(.Listener);
  start(run, clothes.getDescription());
  wash(run);
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  finish(run, clothes.getDescription());
  removeListener(.Listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
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```

Koreferenz

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
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  setListener(.Listener);
  start(run, clothes.getDescription());
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new WashingMachine().wash(
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Indirekte Anaphern

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class WashingMachine {
 Run wash(Clothes clothes, User user) {
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     listener=user.getListener();
  setListener(.Listener);
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  spinDry(run);
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new WashingMachine().wash(
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class WashingMachine {
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Indirekte Anaphern

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  wash(run);
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  finish(run, .Description);
  removeListener(.Listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Weitere direkte Anaphern

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
  MachineListener
     listener=user.getListener();
  setListener(.Listener);
  start(run, .Description);
  wash(run);
  spinDry(run);
  finish(run, .Description);
  removeListener(.Listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Weitere direkte Anaphern

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
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  setListener(.Listener);
  start(.Run, .Description);
  wash(.Run);
  spinDry(.Run);
  finish(.Run, .Description);
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Eine direkte in eine indirekte Anapher umwandeln

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  new Run();
  MachineListener
     listener=user.getListener();
  setListener(.Listener);
  start(.Run, .Description);
  wash(.Run);
  spinDry(.Run);
  finish(.Run, .Description);
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Eine direkte in eine indirekte Anapher umwandeln

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  new Run();


  setListener(.Listener);
  start(.Run, .Description);
  wash(.Run);
  spinDry(.Run);
  finish(.Run, .Description);
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Zum Vergleich: die initiale Version

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  Run run = new Run();
  MachineListener
     listener=user.getListener();
  setListener(listener);
  start(run, clothes.getDescription());
  wash(run);
  spinDry(run);
  finish(run, clothes.getDescription());
  removeListener(listener);
  return run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Aussichten

- Kürzerer Code durch referentielle Unterspezifikation
- Interessanterer Code durch Kohärenzlücken
- Keine komplizierten „künstlichen“ Sprachfunktionen
- Praktische Anwendung linguistischer Modelle wie Schwarz (2000)

Probleme: Referentielle Ambiguität

```
class WashingMachine {
 Run wash(Clothes c1, Clothes c2, User
    user) {
  new Run();
  setListener(.Listener);
  start(.Run, .Description);
  wash(.Run);
  spinDry(.Run);
  finish(.Run, .Description);
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my
     trousers")),
  new Clothes(new Description("my socks")),
  new User());
```

Probleme: Referentielle Ambiguität

```
class WashingMachine {
 Run wash(Clothes c1, Clothes c2, User
    user) {
  new Run();
  setListener(.Listener);
  start(.Run, .Description);
  wash(.Run);
  spinDry(.Run);
  finish(.Run, .Description);
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my
     trousers")),
  new Clothes(new Description("my socks")),
  new User());
```

Probleme: Kontrollstrukturen

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  if(clothes.needCleaning()) {
    new Run();
    setListener(.Listener);
    start(.Run, .Description);
    wash(.Run);
    spinDry(.Run);
    finish(.Run, .Description);
    removeListener(.Listener);
  }
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Probleme: Kontrollstrukturen

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
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    wash(.Run);
    spinDry(.Run);
    finish(.Run, .Description);
    removeListener(.Listener);
  }
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Probleme: Fokus

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  new Run();
  setListener(.Listener);
  wash(.Run);
  spinDry(.Run);
  if(clothes.stillDirty()) {
    new Run();
    wash(.Run);
    spinDry(.Run);
  }
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Probleme: Fokus

```
class WashingMachine {
 Run wash(Clothes clothes, User user) {
  new Run();
  setListener(.Listener);
  wash(.Run);
  spinDry(.Run);
  if(clothes.stillDirty()) {
    new Run();
    wash(.Run);
    spinDry(.Run);
  }
  removeListener(.Listener);
  return .Run;
}}
new WashingMachine().wash(
  new Clothes(new Description("my socks")),
  new User());
```

Grundlegende Probleme

- Lernen durch Lesen bei Unterspezifikation
- Deterministisch vs. probabilitisch
- Natürliche Kategorien: Ross u. Makin (1999) vs. Knöll u. a. (2011)
- Fokus und Aktivierung: Engle u. Oransky (1999)
- Naturalistische Programmierung (Lopes u. a., 2003; Knöll u. Mezini, 2006): Empirische Beurteilung der Natürlichkeit
- Berechenbarkeit / Komplexität / Optimalität
- Isolierbarkeit einzelner Funktionalitäten natürlicher Sprachen

Diskussion

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Dokumentation, Quellcode, RSS-Feed & E-Mail Newsletter:
http://www.monochromata.de/lop

Diaspora-Handle:
monochromata@pod.geraspora.de

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