Team Cognition in sport
Insights into how teamwork is achieved in naturallistic settings

Jérôme Bourbousson
Associate Professor
University of Nantes
Overview

1. From ‘Group dynamics’ to ‘Teamwork’
2. Existing theoretical perspectives
3. Naturalistic settings: Empirical evidences that question theories
4. What should we remember?
1. From ‘Group dynamics’ to ‘Teamwork’

Team sports / Team performance

Training/coaching a team = I want to build the ‘best team’ so that we would have good chance to win the game

«How often does the best team win?»

Lopez et al., 2017
Explaining team success through team intrinsic value
(Foot, Basket, Ice-Hockey…)
Analysis of a 10-years window

Results
The best team (‘’better on paper’’) won in only 50% of instances

‘Intrinsic value’ of the team (talented players) is a bad predictor of performance

‘An expert team is more than a team of experts’ (Eccles & Tenenbaum, 2004)
1. From ‘Group dynamics’ to ‘Teamwork’

**Team sports / Team performance**

Training/coaching a team = I want to build the ‘best team’ so that we would have good chance to win the game

«How often does the best team win?»

‘Intrinsic value’ of the team  
*(as captured by individual talents level)*

does not account for « team togetherness »

50%

‘Intrinsic value’ of the team (talented players) is a bad predictor of performance

‘An expert team is more than a team of experts’ (Eccles & Tenenbaum, 2004)
1. From ‘Group dynamics’ to ‘Teamwork’

**Group dynamics**

**Cohesion**

Feeling of togetherness, as experienced by team members regarding their common goals and social relationships

**Leadership**

Social transaction, as achieved within a team, between members and that lad one (or more) of them to drive the group towards desired goals

**Collective efficacy**…

Beliefs related to capability to cope with team adversity
1. From ‘Group dynamics’ to ‘Teamwork’

<table>
<thead>
<tr>
<th>Best year-performance</th>
<th>US</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>France</strong></td>
<td><strong>US</strong></td>
</tr>
<tr>
<td>Patricia Girard 11.45</td>
<td>Angela Williams 11.15</td>
</tr>
<tr>
<td>Muriel Hurtis 11.08</td>
<td>Chryste Gaines 10.86</td>
</tr>
<tr>
<td>Sylviane Félix 11.28</td>
<td>Inger Miller 11.16</td>
</tr>
<tr>
<td>Christine Arron 11.01</td>
<td>Torri Edwards 10.93</td>
</tr>
<tr>
<td><strong>Total 44.82</strong></td>
<td><strong>Total 44.1</strong></td>
</tr>
<tr>
<td><strong>6.4 meters (expected)</strong></td>
<td></td>
</tr>
</tbody>
</table>

What does allow this team to win?
Intrinsic value of the team?
Cohesion ?
Leadership ?
Collective efficacy ?
1. From ‘Group dynamics’ to ‘Teamwork’

**Group dynamics**

**Cohesion**
Feeling of togetherness, as experienced by team members regarding their common goals and social relationships

**Leadership**
Social transaction, as achieved within a team, between members and that lad one (or more) of them to drive the group towards desired goals

**Collective efficacy**…
Beliefs related to capability to cope with team adversity
1. From ‘Group dynamics’ to ‘Teamwork’

What changed?

Teamwork

McEwan & Beauchamp (2014) = Team processes

-What make the team function effectively

-What and how team members do to achieve team effectiveness

…Planning/managing conflict/regulating interpersonal emotions

…Building a cognitive network of mutual understanding /Building a network of coordinated movements
1. From ‘Group dynamics’ to ‘Teamwork’

What does teamwork investigation promises?

Understanding why Team inputs did not at best explain team performance variations

«Command-and-control teams »
Cooke et al., 2013
Controlling/Mesuring various variables (inputs, processes, outputs)
The best predictor for Team Performance?
Résultats
1-Situated interactions quality
…
-individual expertise
-team composition
-team training

Jerome.bourbousson@univ-nantes.fr
1. From ‘Group dynamics’ to ‘Teamwork’

Teamwork investigation
Functioning together in the real-time

Team sports
Coordinating with others
Overview

1. From ‘Group dynamics’ to ‘Teamwork’
2. Existing theoretical perspectives
3. Naturalistic settings: Empirical evidences that question theories
4. What should we remember?
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Team coordination is conceived as…

- Allowed by ‘Team cognition’
TC = how shared knowledge can be represented in groups of coordinating individuals’

Human ontology
Processing information
Representation is responsible for the organization and regulation of behaviours

Shared knowledge in teams
Social-cognitive Framework
Eccles & Tenenbaum, 2004
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Team coordination is conceived as…

Shared knowledge in teams
Social-cognitive Framework
Eccles & Tenenbaum, 2004

= Implicit coordination
2. Existing theoretical perspectives

Study object: Teamwork
- Situated interaction
- Team coordination
- Team synergies
- Team synchrony

Shared knowledge in teams
Social-cognitive Framework
Eccles & Tenenbaum, 2004

Empirical studies showed that...

Double tennis
Blickensderfer et al. (2010)

Participants
71 teams (English League)

Mesures:
- Task Shared knowledge (task familiarity)
- Team Shared knowledge (team familiarity)
- Team coordination (video analysis of behaviors)

Figure 3. Model results: Standardized regression weights.
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Shared affordances in teams
Ecological Dynamics Framework
Araujo & Davids, 2016

Team coordination is conceived as…
-No need of investigating the microlevel of the individual’s interior.

Human ontology
Embodiment of cognition (affordances)
Embeddedness in the environment
2. Existing theoretical perspectives

Study object: Teamwork
- Situated interaction
- Team coordination
- Team synergies
- Team synchrony

Shared affordances in teams
Ecological Dynamics Framework
Araujo & Davids, 2016

Team coordination is conceived as...

Team coordination depends on the collective attunement to shared affordances founded on a prior platform of (mainly non-verbal) information exchange (Silva et al., 2013).
2. Existing theoretical perspectives

Study object: Teamwork

- Situated interaction
- Team coordination
- Team synergies
- Team synchrony

Shared affordances in teams
Ecological Dynamics Framework
Araujo & Davids, 2016

Team coordination is conceived as...

Team coordination depends on the collective attunement to shared affordances founded on a prior platform of (mainly non-verbal) information exchange (Silva et al., 2013).
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Shared affordances in teams
Ecological Dynamics Framework
Araujo & Davids, 2016

Team coordination is conceived as…

Team coordination depends on the collective attunement to shared affordances founded on a prior platform of (mainly non-verbal) information exchange (Silva et al., 2013).

Collective mutual attunement to each other behaviors
= Complex system-like coordination processes
2. Existing theoretical perspectives

**Study object: Teamwork**
- Situated interaction
- Team coordination
- Team synergies
- Team synchrony…

**Shared affordances in teams**

**Ecological Dynamics Framework**

_Araujo & Davids, 2016_

**Empirical studies showed that…**

Decision making can be understood from only behavioural data

[futsal]

Spatiotemporal correlates of initiating a pass to a teammate

= finding a space-time structure that predict when a pass will (or not) occur

**Training**

Constraints-led approach: making athletes sensitive to ‘good’ affordances

_Travassos et al., 2011_
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Shared meaningful worlds in teams
Enactivist approach to teamwork
De Jaegher & Di Paolo, 2007

What are the essentials of this approach?
Cognition is conceived with respect to a phenomenological approach to humans, which assumes the sense-making process to highly contribute to the human/environment coupling

Evan Thompson

Précis of Mind in Life: Biology, Phenomenology, and the Sciences of Mind
Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

What are the essentials of this approach?

Coordination of activities:

…depends on how individual ‘own worlds’ interact/interplays in the ongoing/unfolding interaction

Shared meaningful worlds in teams
Enactivist approach to teamwork
De Jaegher & Di Paolo, 2007
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Shared meaningful worlds in teams
Enactivist approach to teamwork
*De Jaegher & Di Paolo, 2007*

What is new to the research with this approach?

- Reconstructing how individual ‘own worlds’ articulate during performance environments

- Determining how these articulations are step-by-step adjusted over time
2. Existing theoretical perspectives

Study object: Teamwork
Situated interaction
Team coordination
Team synergies
Team synchrony…

Empirical studies showed that…

In naturallistic settings, shared understanding as achieved in naturallistic setting is -quite precarious, non-fully realized…

Team coordination unfolds through ‘points of cognitive connection’ that are episodic and local when arranging athletes’ own worlds together

Poizat et al., 2009

De Jaegher & Di Paolo, 2007
Overview

1. From ‘Group dynamics’ to ‘Teamwork’
2. Existing theoretical perspectives
3. Naturalistic settings: Empirical evidences that question theories
4. What should we remember?
Team Cognition in sport: Insights into how teamwork is achieved in naturalistic settings

3. Naturalistic settings: Empirical evidences that question theories

In theory…

Point 1 – Expert teams use implicit coordination as a way of interacting

Team members have similar expectations about how the action will unfold…
…so that they can coordinate accurately without any explicit verbal communication

Double tennis teams – On-the-field- games

Data collection
- Teams composed of 2 members
- Audio-video recording of games

Analyses
Verbal communication
(Amount / Content)

Results

Amount of verbal communication
- Winning teams: more use or verbal communication (x2)
- Winning points: more use or verbal communication

Content of verbal communication
- Winning teams: « What will you do? » / « I will do that… »

Lausic et al., 2009
3. Naturalistic settings: Empirical evidences that question theories

In naturalistic settings’ investigation…

Issue 1 – Expert teams make extensive use of overt communication (to update ongoing shared understanding)

...in that existing shared knowledge is not sufficient to allow for shared understanding

Double tennis teams – On-the-field- games

Data collection
- Teams composed of 2 members
- Audio-video recording of games

Analyses
Verbal communication (Amount / Content)

Results
Amount of verbal communication
- Winning teams: more use or verbal communication (x2)
- Winning points: more use or verbal communication

Content of verbal communication
- Winning teams: « What will you do? » / « I will do that… »

Lausic et al., 2009
3. Naturalistic settings: Empirical evidences that question theories

In theory...

**Point 2** – Implicit coordination is achieved when Shared knowledge (SK) is made available within the team

…so that most of their coordination capabilities are considered an « input »

= the more the team will possess SK, the more it will coordinate effortless

---

**Case study - Basketball team – Real game**

**Data collection**
Self-confrontation interviews

**Analyses**
- Eliciting the knowledge mobilized at every instant of the activity (for each player)
- Which knowledge is shared?

**Results**

![Graph showing amount of shared knowledge](image)

*Expected vs. Observed*
3. Naturalistic settings: Empirical evidences that question theories

In naturalistic settings’ investigation...

**Issue 2.1** – Most of the knowledge mobilised by team members during the game is not « shared » by other members

**Sharedness is patterned through « local zones of sharing »**

![Local-and-distributed type of model](image)

**Case study - Basketball team – Real game**

**Data collection**
Self-confrontation interviews

**Analyses**
- Eliciting the knowledge mobilized at every instant of the activity (for each player)
- Which knowledge is shared?

**Results**

- Observed
- Expected

[Bourbousson et al., 2011]
In theory...

Point 2 – Implicit coordination is achieved when Shared knowledge (SK) is made available within the team

…so that most of their coordination capabilities are considered an « input »

= the more the team will possess SK, the more it will coordinate effortless

Case study - Basketball team – Real game

Pre-game

Bourbousson et al., 2011

Post-game
3. Naturalistic settings: Empirical evidences that question theories

In naturalistic settings’ investigation…

**Issue 2.2** – Existing shared knowledge « evolves » during the game due to changes at the individual scale (*to maintain the accuracy of the knowledge*)

…so that ‘sharedness’ must be monitored/updated online

‘Sharedness’ is (probably) less important than online processes of ‘sharing’

---

**Case study - Basketball team – Real game**

**Pre-game**

- a) Reinforcement of a previous element of shared knowledge
- b) Invalidation of an element of shared knowledge
- c) Reinforcement of a previous element of shared knowledge
- d) Creation of a new element of shared knowledge

**Post-game**

- A

*Bourbousson et al., 2011*
In theory…

Point 3 – Expert team members are reciprocally aware to their activities, respectively

-Everyone is aware to everyone (in the game)
- A shared platform of (mainly non-verbal) information exchange

Basketball – Novice/expert teams (real games)

Data collection
- Self-confrontation interviews

Analyses
Which teammates are taken into account at each instant of the game?
- Drawing the network of shared awareness (at any instant)

Results

Expert team =
Lower ‘amount’ of cognitive linkages
Lower ‘reciprocity’ of cognitive linkages

Bourbousson et al., 2015
3. Naturalistic settings: Empirical evidences that question theories

**Results**

**Triadic closure**, as achieved regarding the level of density

**Basketball – Novice/expert teams (real games)**

**Data collection**
- Self-confrontation interviews

**Analyses**
Which teammates are taken into account at each instant of the game?
- Drawing the network of shared awareness (at any instant)

**Results**

Bourbousson et al., 2015
3. Naturalistic settings: Empirical evidences that question theories

In naturalistic settings’ investigation…

**Issue 3** – ‘Interconnectivity’ assumptions are too strong, since every player cannot consider each of his teammates at each instant of the game

…so that connections within the team are distributed but very patterned

---

**Basketball – Novice/expert teams (real games)**

**Data collection**
- Self-confrontation interviews

**Analyses**
- Which teammates are taken into account at each instant of the game?
- Drawing the network of shared awareness (at any instant)

**Results**

Bourbousson et al., 2015

Jerome.bourbousson@univ-nantes.fr
3. Naturalistic settings: Empirical evidences that question theories

In theory…

**Point 4** – Team coordination depends on team synergies (prior to / emerging in the setting)

*Social-cognitive approach*

‘Processes’ help ‘team routines’ to convert into ‘outputs’… so that **team coordination rather depends on inputs than on the dynamical setting**

*Affordance-led approach*

Affordances are searched in player-player spatiotemporal relationships… so that **indirect coordination is not considered**

**Rowing – Novice/expert teams (real races)**

**Data collection**
- 2-members teams
- Self-confrontation interviews
- Mechanical data (as captured from the oars and boat)
- Before/After team performance training

**Analyses**

Which information do teammates use to adapt and help collective behavior to emerge?

**Results**

- Novices
  - Inter-personal

- Experts
  - Extra-personal

*R’Kiouak et al., 2016, 2018*
3. Naturalistic settings: Empirical evidences that question theories

**In naturalistic settings’ investigation…**

**Issue 4** – Team Cognition is embedded in the « dynamical environment » in which it unfolds

! Shared environment, *when it is dynamical enough*, can serve as a glue that holds together teammates activities

---

**Rowing – Novice/expert teams (real races)**

**Data collection**
- 2-members teams
- Self-confrontation interviews
- Mechanical data (as captured from the oars and boat)
- Before/After team performance training

**Analyses**
Which information do teammates use to adapt and help collective behavior to emerge?

**Results**
- Novices
  - Inter-personal

- Experts
  - Extra-personal

*R’Kiouak et al., 2016, 2018*
3. Naturalistic settings: Empirical evidences that question theories

In theory…

**Point 5** – Athletes are attuned to local information

Affordances rely in the player-player coordination

Awareness is local

**Soccer – Expert players (real game)**

**Data collection**
- 10 players
- Self-confrontation interviews

**Analyses**
Which information do they use to adapt and help collective behavior to emerge?

**Results**

Feigean et al., à paraître
In naturalistic settings’ investigation…

**Issue 5** – Team members are attuned to local or global information about the spatiotemporal collective behavior

…so that their capability to switch between local/global modes of regulation could be one important area of expertise to be considered

Global awareness = holoptism

---

**Soccer – Expert players (real game)**

**Data collection**
-10 players
-Self-confrontation interviews

**Analyses**
Which information do they use to adapt and help collective behavior to emerge?

**Results**

Feigean et al., à paraître
Overview

1. From ‘Group dynamics’ to ‘Teamwork’
2. Existing theoretical perspectives
3. Naturalistic settings: Empirical evidences that question theories
4. What should we remember?
4. What should we remember?

- Team performance is more than the mere sum of individual performances
  The potential gap between team intrinsic value and team real-world performance increases with respect for team interdependence/opportunities for coordination

Simple interdependence (sequential)

Complex interdependence (collective)
4. What should we remember?

- Team performance is more than the mere sum of individual performances
  The potential gap between team intrinsic value and team real-world performance increases with respect for team interdependence/opportunities for coordination

- Team inputs do not predict team performance / Ongoing social interaction (i.e., teamwork) do it better

- Teamwork is ‘what and how teams do’ in the real-time

- Team Cognition is ‘interactive’, it is mostly seen to emerge online when studying team coordination ‘in the wild’
4. What should we remember?

My Opinion: How is teamwork achieved in naturalistic settings?

- Players’ awareness of the game is very singular (depending on their own worlds)
  - Perfect moments of shared understanding in action are very scarce
  - Social encounter is made of ‘points of connection’ that are episodic, local, and indirect

- While coordination is local/indirect, it is patterned in expert teams
  - At least at a triadic level
  - Alternating with moments of holoptism

- Such observations are made available thanks to players’ shared sensitivity to their common environment
  - Shared environment serves as a ‘glue’ to put various ‘own worlds’ together
  - Allowing for cognitive entrainment within the team

- Knowledge is useful during the game
  - Low sharedness (preferential interactions)
  - Dynamics of knowledge’s updating (processes) matters more than the pool of knowledge shared prior to the game (inputs)

- Overt communication is needed
  - Shared understanding achievement calls for online information exchanges

Jerome.bourbousson@univ-nantes.fr
Team Cognition in sport: Insights into how teamwork is achieved in naturalistic settings

Merci de votre attention